



GREATER MEKONG SYSTEM REGIONAL GRID CODE


Load Frequency Control & Reserves Code (Draft)

6 of 10 Code Documents

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Version control

		
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Note: A section titled "ANNEX: Code – History of Comments" is attached to each Code. It provides a log of every comment and subsequent consideration taken on the Code.

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1. General Provision

1.1 Subject Matter and Scope

- (1) This Network Code defines the minimal requirements and principles for load-frequency control and reserves applicable to all TSOs, Reserve Connecting DSOs and Reserve Providers.
- (2) This Network Code aims at:
 - a) achieving and maintaining a satisfactory level of System Frequency quality and efficient utilisation of the power system and resources;
 - b) ensuring coherent and coordinated behaviour of the transmission systems and power systems in real-time operation; and
 - c) determining common requirements and principles for FCR, FRR and RR; and determining common requirements for cross-border exchange, sharing, activation and sizing of reserves.
- (3) For the power systems operating in a Synchronous Area whose frequency is influenced in a predominant way by systems that are not bound by the GMS legislation, provisions of this Network Code shall apply only to the extent that they could be duly, physically and technically applied and implemented by the respective TSO.
- (4) The provisions of this Network Code shall not apply to the Transmission System or parts of the Transmission System of a member State, which is not operating synchronously with or which is temporarily disconnected from the rest of the Synchronous Area.
- (5) The provisions of the Network Code are without prejudice to the relevant provisions for human and nuclear safety.
- (6) No action in fulfilment of this Network Code shall hinder the implementation of new applications.
- (7) In the implementation of the technical and other requirements set in this Network Code, each TSO shall comply with good industry practice.
- (8) This code is based on GMS Transmission Policies 1 to 4, GMS Performance Standards and the GMS Load Frequency Control & Reserves Guidelines.

1.2 Definitions

- (1) For the purposes of this Regulation, the definitions contained in the GMS Glossary of Terms shall apply.
- (2) In addition the following definitions shall apply and are added to the GMS Glossary of Terms:

Adjacent LFC Areas – means LFC Areas having a common electrical border.

Adjacent LFC Blocks – means LFC Blocks having a common electrical border.

Affected TSO – means a TSO for which information on the Exchange of Reserves and/or Sharing of Reserves and/or Imbalance Netting Process and/or Cross-Border Activation Process is needed for the analysis and maintenance of Operational Security.

Alert State Trigger Time – means the time until Alert State becomes active.

Automatic FRR – means FRR that can be activated by an automatic control device.

Automatic FRR Activation Delay – means the period of time between the setting of a new Setpoint value by the frequency restoration controller and the start of physical Automatic FRR delivery.

Automatic FRR Full Activation Time – means the time period between the setting of a new Setpoint value by the frequency restoration controller and the corresponding activation or deactivation of Automatic FRR.

Average FRCE Data – means the Set of data consisting of the average value of the recorded instantaneous FRCE of a LFC Area or a LFC Block within a given measurement period time.

Connection Point – means the interface at which the Power Generating Module, Demand Facility, Distribution Network or Closed Distribution Network is connected to a Transmission System, Distribution Network or Closed Distribution Network.

Control Capability Providing TSO – means the TSO which shall trigger the activation of its Reserve Capacity for a Control Capability Receiving TSO under conditions of an agreement for the Sharing of Reserves.

Control Capability Receiving TSO – means the TSO calculating Reserve Capacity by taking into account Reserve Capacity which is accessible through a Control Capability Providing TSO under conditions of an agreement for the Sharing of Reserves.

Criteria Application Process – means the process of calculation of the target parameters for the Synchronous Area, the LFC Block and the LFC Area based on the data obtained in the Data Collection and Delivery Process.

Cross-Border FRR Activation Process – means a process agreed between the TSOs participating in the process that allows for activation of FRR connected in a different LFC Area by correcting the input of the involved FRPs accordingly.

Cross-Border RR Activation Process – means a process agreed between the TSOs participating in the process that allows for activation of RR connected in a different LFC Area by correcting the input of the involved RRP accordingly.

Data Collection and Delivery Process – means the Process of collection of the set of data necessary in order to perform the Frequency Quality Evaluation Criteria.

Dimensioning Incident – means the highest expected instantaneously occurring Active Power Imbalance within a LFC Block in both positive and negative direction.

Electrical Time Deviation – means the time discrepancy between synchronous time and Universal Time Coordinated (UTC).

Exchange of Reserves – means a concept for a TSO to have the possibility to access Reserve Capacity connected to another LFC Area, LFC Block, or Synchronous Area to comply with the amount of required reserves resulting from its own reserve dimensioning process of either FCR, FRR or RR. These reserves are exclusively for this TSO, meaning that they are not taken into account by any other TSO to comply with the amount of required reserves resulting from their respective reserve dimensioning processes.

FCR Full Activation Frequency Deviation – means the rated value of Frequency Deviation at which the FCR in a Synchronous Area is fully activated.

FCR Full Activation Time – means the time period between the occurrence of the Reference Incident and the corresponding full activation of the FCR.

FCR Obligation – means the part of all of the FCR that falls under the responsibility of a TSO.

Frequency Containment Process (FCP) – means a process that aims at stabilizing the System Frequency by compensating imbalances by means of appropriate reserves.

Frequency Quality Defining Parameters – means the main System Frequency variables that define the principles of Frequency Quality.

Frequency Quality Evaluation Criteria – means a set of calculations using System Frequency measurements that allow the evaluation of the quality of the System Frequency against the Frequency Quality Target Parameters.

Frequency Quality Evaluation Data – means the set of data that allows the calculation of the Frequency Quality Evaluation Criteria.

Frequency Quality Target Parameter – means the main System Frequency target variables on which the behaviour of FCR, FRR and RR activation processes are evaluated in Normal State.

FRCE Target Parameters – means the target main LFC Block variables on basis of which the dimensioning criteria for FRR and RR of the LFC Block are determined and evaluated. These parameters reflect the LFC Block behaviour in normal operation.

Frequency Restoration Power Interchange – means the Power which is interchanged between LFC Areas within the Cross-Border FRR Activation Process.

Frequency Restoration Reserves (FRR) – means the Active Power Reserves activated to restore System Frequency to the Nominal Frequency and for Synchronous Area consisting of more than one LFC Area power balance to the scheduled value.

Frequency Setpoint – means the Frequency target value used in the FRP defined as the sum of the Nominal System Frequency and an offset value needed to reduce an Electrical Time Deviation.

FRR Availability Requirements – means a set of requirements defined by the TSOs of a LFC Block regarding the availability of FRR.

FRR Dimensioning Rules – means the specifications of the FRR dimensioning process of a LFC Block.

Imbalance Netting Power Interchange – means the power which is interchanged between LFC Areas within the Imbalance Netting Process.

Imbalance Netting Process – means a process agreed between TSOs of two or more LFC Areas within one or more than one Synchronous Areas that allows for avoidance of simultaneous FRR activation in opposite directions by taking into account the respective FRCEs as well as activated FRR and correcting the input of the involved FRPs accordingly.

Initial FCR Obligation – means the amount of FCR allocated to a TSO on the basis of a general sharing key.

Instantaneous Frequency Data – means a set of data measurements of the overall System Frequency for the Synchronous Area with a measurement period

equal to or shorter than 1 second used for System Frequency quality evaluation purposes.

Instantaneous Frequency Deviation – means a set of data measurements of the Frequency Deviation with a measurement period equal to or shorter than 1 second.

Instantaneous FRCE Data – means a set of data of the FRCE for a LFC Block with a measurement period equal to or shorter than 10 seconds used for System Frequency quality evaluation purposes.

Level 1 FRCE Range – means the first range used for System Frequency quality evaluation purposes on LFC Block level within which the FRCE should be kept for a specified percentage of the time.

Level 2 FRCE Range – means the second range used for System Frequency quality evaluation purposes on LFC Block level within which the FRCE should be kept for a specified percentage of the time.

LFC Block Operational Agreement – means a multi-party agreement between all TSOs of a LFC Block if the LFC Block consists of more than one TSO; if a LFC Block consists only of one TSO, it means a formal declaration of obligations.

LFC Block Imbalances – means the sum of the FRCE, FRR Activation and RR Activation within the LFC Block and the Imbalance Netting Power Exchange, the Frequency Restoration Power Interchange and the Replacement Power Interchange of this LFC Block with other LFC Blocks.

LFC Block Monitor – means a TSO responsible for collecting the Frequency Quality Evaluation Criteria Data and applying the Frequency Quality Evaluation Criteria for the LFC Block.

Load-Frequency Control Structure – means the basic structure considering all relevant aspects of Load Frequency Control in particular concerning respective responsibilities and obligations (Process Responsibility Structure) as well as types and purposes of Active Power Reserves (Process Activation Structure).

Manual FRR Full Activation Time – means the time period between the Setpoint change and the corresponding activation or deactivation of manual FRR.

Maximum Instantaneous Frequency Deviation – means the maximum expected absolute value of an Instantaneous Frequency Deviation after the occurrence of an imbalance equal or less than the Reference Incident, beyond which emergency measures are activated.

Monitoring Area – means a part of the Synchronous Area or the entire Synchronous Area, physically demarcated by points of measurement of Tie-Lines to other Monitoring Areas, operated by one or more TSOs fulfilling the obligations of a Monitoring Area.

Operational Security – means the Transmission System capability to retain a Normal State or to return to a Normal State as soon and as close as possible, and is characterised by thermal limits, voltage constraints, short-circuit current, frequency limits and stability limits.

Prequalification – means the process to verify the compliance of a Reserve Providing Unit or a Reserve Providing Group of kind FCR, FRR or RR with the requirements set by the TSO according to principles stipulated in this code.

Process Activation Structure – means the structure to categorize the processes concerning the different types of Active Power Reserves in terms of purpose and activation.

Process Responsibility Structure – means the structure to determine responsibilities and obligations with respect to Active Power Reserves based the control structure of the Synchronous Area.

Ramping Period – means a period of time defined by a fixed starting point and a length of time during which the input and/or output of Active Power will be increased or decreased.

Replacement Power Interchange – means the power which is interchanged between LFC Areas within the Cross-Border RR Activation Process.

Replacement Reserves (RR) – means the reserves used to restore/support the required level of FRR to be prepared for additional system imbalances. This category includes operating reserves with activation time from Time to Restore Frequency up to hours.

Reserve Capacity – means the amount of FCR, FRR or RR that needs to be available to the TSO.

Reserve Connecting DSO – means the DSO responsible for the Distribution Network to which a Reserve Providing Unit or Reserve Providing Group, providing reserves to a TSO, is connected.

Reserve Connecting TSO – means the TSO responsible for the Monitoring Area to which a Reserve Providing Unit or Reserve Providing Group is connected to.

Reserve Instructing TSO – means the TSO responsible for the instruction of the Reserve Providing Unit or the Reserve Providing Group to activate FRR and/or RR.

Reserve Provider – means a legal entity with a legal or contractual obligation to supply FCR, FRR or RR from at least one Reserve Providing Unit or Reserve Providing Group.

Reserve Providing Group – means an aggregation of Power Generating Modules, Demand Unit and/or Reserve Providing Units connected to more than one Connection Point fulfilling the requirements for FCR, FRR or RR.

Reserve Providing Unit – means a single or an aggregation of Power Generating Modules and/or Demand Units connected to a common Connection Point fulfilling the requirements for FCR, FRR or RR.

Reserve Receiving TSO – means the TSO involved in an exchange with a Reserve Connecting TSO and/or a Reserve Providing Unit or a Reserve Providing Group connected to another Monitoring or LFC Area.

Reserve Replacement Process (RRP) – means a process to restore activated FRR.

RR Availability Requirements – means a set of requirements defined by the TSOs of a LFC Block regarding the availability of RR.

RR Dimensioning Rules – means the specifications of the RR dimensioning process of a LFC Block.

Sharing of Reserves – means a mechanism in which more than one TSO take the same Reserve Capacity, being FCR, FRR or RR, into account to fulfil their respective reserve requirements resulting for their reserve dimensioning processes.

Standard Frequency Deviation – means the absolute value of the Frequency Deviation that limits the Standard Frequency Range.

Standard Frequency Range – means a defined interval symmetrically around the Nominal Frequency within which the System Frequency of a Synchronous Area is supposed to be operated.

Steady State Frequency Deviation – means the absolute value of Frequency Deviation after occurrence of an imbalance, once the System Frequency has been stabilized.

Synchronous Area – means an area covered by interconnected TSOs with a common System Frequency in a steady operational state.

Synchronous Area Monitor – means a TSO responsible for collecting the Frequency Quality Evaluation Criteria Data and applying the Frequency Quality Evaluation Criteria for the LFC Block.

Time Control Process – means a process for time control, where time control is a control action carried out to return the Electrical Time Deviation between synchronous time and UTC time to zero.

Time to Restore Frequency – for Synchronous Areas with more than one LFC Area, the Time to Restore Frequency is the maximum expected time after the occurrence of an imbalance of an LFC Area within which the imbalance is compensated.

Virtual Tie-Line – means an additional input of the controllers of the involved areas that has the same effect as a measuring value of a physical Tie-Line and allows exchange of electric energy between the respective areas.

1.3 Regulatory Aspects

- (1) The requirements established in this Network Code and their applications are based on the principle of proportionality, non-discrimination and transparency as well as the principle of optimization between the highest overall efficiency and lowest total cost for all involved parties.
- (2) Notwithstanding the above, the application of the principle of non-discrimination and the principle of optimization between the highest overall efficiency and lowest total costs while maintaining Operational Security as the highest priority for all involved parties, shall be balanced with the aim of achieving the maximum transparency in issues of interest for the market and the assignment to the real originator of the costs.
- (3) The terms and conditions or actions necessary to ensure Operational Security or their methodologies shall be established by TSOs in accordance with the principles of transparency, proportionality and non-discrimination. The definition of these terms and conditions or actions necessary to ensure Operational Security shall be performed in compliance with and respecting the TSO's responsibility to ensure system security according to national legislation.
- (4) When defining terms and conditions or actions necessary to ensure Operational Security pursuant to this Network Code, a TSO shall in addition to the principles set in paragraph 1 take into account at least the following:
 - a) characteristics of the system;
 - b) operational conditions; and
 - c) overall efficiency.

- (5) This Network Code relies on the capabilities required in the GMS Connection Network Code, Chapter 2, “Requirements for Generators (RfG)”, and Chapter 4, “Demand Connection”. The Power Generating Facilities, Demand Facilities and HVDC links that are not a subject of the provisions in Chapters 2 & 4 of the [GMS Connection Network Code] shall continue to be bound by those technical requirements that apply to them pursuant to legislation in force in the respective GMS Member State or contractual arrangements in force.

1.4 Regulatory Approvals

- (1) National Regulatory Authority or, when explicitly foreseen in national law, other relevant national authority shall be responsible for approving the methodologies and conditions establishing the framework for the adoption by TSOs of terms and conditions or actions necessary to ensure Operational Security as referred to in the Section 1.4, paragraphs (2) to (4).
- (2) Each TSO shall submit the following methodologies and conditions established by the TSO to the National Regulatory Authority or, when explicitly foreseen in national law, other relevant national authority for approval:
- a) The additional requirements for FCR Providing Groups pursuant to Section 6.2 paragraph (3);
 - b) The exclusion of FCR Providing Groups from the provision of FCR pursuant to Section 6.2 paragraph (3);
 - c) FRR technical requirements defined by the TSO pursuant to Section 7.2 paragraph (3);
 - d) The exclusion of FRR Providing Groups from the provision of FRR pursuant to Section 7.2 paragraph (4);
 - e) RR technical requirements defined by the TSO pursuant to Section 8.2 paragraph (3); and
 - f) The exclusion of RR Providing Groups from the provision of RR pursuant to Section 8.2 paragraph (4).
- (3) Each TSO of a LFC Block shall submit the following methodologies and conditions established by the TSOs of a LFC Block to its National Regulatory Authority or, when explicitly foreseen in national law, other relevant national authorities for approval:
- a) Definition of mitigation measures pursuant to Section 3.11;
 - b) Definition of the Process Responsibility Structure pursuant to Section 4.3;
 - c) The definition of the methodology to limit the amount of FRR Capacity that can be made available for the Cross-Border FRR Activation Process pursuant to Section 4.8, paragraph (7);
 - d) The definition of the methodology to limit the amount of RR Capacity that can be made available for the Cross-Border RR Activation Process pursuant to Section 4.9, paragraph (7);
 - e) The measures to reduce the FRCE by requiring changes in the Active Power production or consumption of Power Generating Modules and Demand Units pursuant to Section 5.1, paragraph (16);
 - f) Definition of FRR dimensioning rules pursuant to Section 7.1, paragraph (1);

- g) Escalation procedure pursuant to Section 7.1, paragraph (4);
 - h) Definition of FRR Availability Requirements and control quality pursuant to Section 7.2, paragraph (2);
 - i) Requirements of RR dimensioning rules pursuant to Section 8.1, paragraph (3);
 - j) Escalation procedure pursuant to Section 8.1, paragraph (7);
 - k) Definition of RR Availability Requirements pursuant to Section 8.2, paragraph (2);
 - l) Limits for the Exchange of FCR within a LFC Block for the GMS Synchronous Area pursuant to Section 9.1.1, paragraph (2);
 - m) Limits for the Exchange of FRR within a LFC Block, Section 9.1.5; and
 - n) Limits for the Exchange of RR within a LFC Block, Section 9.1.7, paragraph (2).
- (4) Each TSO of a Synchronous Area shall submit the following methodologies and conditions established by the TSOs of a Synchronous Area to its National Regulatory Authority or, when explicitly foreseen in national law, other relevant national authorities for approval:
- a) The modification of the Frequency Quality Defining Parameters or the Frequency Quality Target Parameter pursuant to Section 3.1 paragraph (6);
 - b) Common methodology to assess the risk of FCR Exhaustion pursuant to Section 3.3, paragraph (3);
 - c) Definition of mitigation measures pursuant to Section 3.11;
 - d) The dimensioning approach for FCR pursuant to Section 6.1, paragraph (2);
 - e) Determination of additional properties of the FCR pursuant to Section 6.2, paragraph (2);
 - f) Limits for the cross Synchronous Area Exchange of FCR pursuant to Section 9.2.2, paragraph (1);
 - g) Limits for the cross Synchronous Area Exchange of FRR pursuant to Section 9.2.5, paragraph (1);
 - h) Limits for the cross Synchronous Area Sharing of FRR pursuant to Section 9.2.6, paragraph (1);
 - i) Limits for the cross Synchronous Area Exchange of RR pursuant to Section 9.2.7, paragraph (1); and
 - j) Limits for the cross Synchronous Area Sharing of RR pursuant to Section 9.2.8, paragraph (1).
- (5) National Regulatory Authorities shall, no later than six months after having received the methodologies or conditions establishing the framework for the adoption by TSOs of terms and conditions or actions necessary to ensure Operational Security, provide TSOs with an approval or a request to amend the proposed methodology or condition.
- (6) Where the concerned National Regulatory Authorities have not been able to reach an agreement within a period of six months from when the case was referred to the last of those National Regulatory Authorities, or upon a joint request from the competent National Regulatory Authorities, the Board of RPCC

shall decide upon these regulatory issues that fall within the competence of National Regulatory Authorities and submit the decision to the RPTCC Meeting for its application.

1.5 Regulatory Notification

- (1) Each TSO shall submit the following methodologies and conditions to its National Regulatory Authority or, when explicitly foreseen in national law, other relevant national authorities, for notification:
 - a) The FRCE Target Parameters pursuant to Section 3.2, paragraph (1);
 - b) The ramping restrictions on Synchronous Area level pursuant to Section 3.9;
 - c) The ramping restrictions on LFC Block level pursuant to Section 3.10;
 - d) The TSO Notification pursuant to Section 4.11, paragraph (1);
 - e) The measure taken in the Alert State due to there being insufficient Active Power Reserves pursuant to Section 5.1, paragraph (10);
 - f) The request of the Reserve Connecting TSO to an FCR Provider to make the information available in real time pursuant to Section 6.2, paragraph (8); and
 - g) At the request of the Reserve Connecting TSO, a FCR Provider has to make available data for technical installations, which are part of the same FCR Providing Unit, in case it is necessary for pursuant to 6.2, paragraph (8).

1.6 Recovery of costs

- (1) The costs related to the obligations referred to in this Network Code, which have to be borne by regulated Network Operators, shall be assessed by National Regulatory Authorities.
- (2) Costs assessed as efficient, reasonable and proportionate shall be recovered as determined by National Regulatory Authorities.
- (3) If requested by National Regulatory Authorities, regulated Network Operators shall, within three months of such a request, use best endeavours to provide such additional information as reasonably requested by National Regulatory Authorities to facilitate the assessment of the costs incurred.

1.7 Confidentiality obligations

- (1) Each TSO, DSO, CDSO, Reserve Provider, Power Generating Facility Operator, Demand Facility Operator and Owners of these Facilities shall preserve the confidentiality of the information and data submitted to them pursuant to this Network Code and shall use them exclusively for the purpose they have been submitted in compliance with the Network Code.
- (2) Without prejudice to the obligation to preserve the confidentiality of commercially sensitive information obtained in the course of carrying out its activities, each TSO shall, in compliance with the provisions of this Network Code, provide to the operator of any other Transmission System with which its system is

interconnected, sufficient information to ensure the secure and efficient operation, coordinated development and interoperability of the interconnected system.

- (3) The RPCC Administration shall preserve the confidentiality of the information and data submitted to them in connection with this Network Code and shall use them exclusively for the purpose they have been submitted.

1.8 Agreement with TSOs not bound by this Network Code

- (1) No later than 12 months after entering into force of this Network Code, all TSOs shall endeavour to implement a Synchronous Area Agreement to ensure that TSOs with no legal obligation to respect this Network Code, belonging to the Synchronous Area, also cooperate to fulfil the requirements.
- (2) If an agreement, according to paragraph (1) or (2) of this Section, cannot be implemented, the respective TSOs shall implement, no later than by [date – 14 months after entry into force], processes to ensure compliance with the requirements of this Network Code within its Responsibility Area.
- (3) If an agreement, according to paragraph (1) of this Section, cannot be implemented within 12 months after entering into force of this Network Code, the TSOs operating in a Synchronous Area whose frequency is influenced in a predominant way by Power systems that are not bound by the GMS regulations, shall nevertheless endeavour to implement a Synchronous Area agreement within their Synchronous Area to ensure that TSOs with no legal obligation to respect this Network Code, belonging to the Synchronous Area, also cooperate to fulfil the requirements.

1.9 TSO Cooperation

Where the TSOs of a Synchronous Area are required to adopt a decision in accordance with this Network Code, all TSOs of a Synchronous Area shall cooperate loyally to adopt the decision.

2. Operational Agreements

2.1 Synchronous Area Operational Agreement

By [date – 12 months after entry into force], all TSOs of each Synchronous Area shall establish a Synchronous Area Operational Agreement that shall at least include:

- a) The dimensioning approach and dimensioning rules for FCR in accordance with Section 6.1, paragraphs (2) and (4);
- b) Additional properties of the FCR in accordance with Section 6.2, paragraph (2);
- c) The Frequency Quality Defining Parameters and the Frequency Quality Target Parameter in accordance with Section 3.1, paragraph (6);
- d) The Frequency Control Error Target Parameters for each LFC Block in accordance with Section 3.2, paragraph (1);
- e) The methodology to assess the risk and the evolution of the risk of FCR Exhaustion of the Synchronous Area in accordance with Section 3.3, paragraph (3);
- f) The Synchronous Area Monitor in accordance with Section 3.5, paragraph (1);
- g) The calculation of the Control Program from the Netted Area AC Position¹ with a common Ramping Period for ACE calculation for a Synchronous Area with more than one LFC Area in accordance with Section 3.8;
- h) If applicable, restrictions for the Active Power output of HVDC Interconnectors between Synchronous Areas in accordance with Section 3.9.
- i) The Load-Frequency Control Structure in accordance with Section 4.1;
- j) If applicable, the methodology to reduce the Electrical Time Deviation in accordance with Section 10.1, paragraph (2);
- k) Whenever the Synchronous Area is operated by more than one TSO, the specific allocation of responsibilities between TSOs in accordance with Section 4.3, paragraph (10);
- l) Operational procedures for the case of exhausted FCR in accordance with Section 5.1, paragraph (8);
- m) Operational procedures to reduce the System Frequency Deviation to restore the System State to Normal State and to limit the risk to enter into Emergency State in accordance with Section 5.1, paragraph (10).
- n) The roles and responsibilities of the TSOs implementing an Imbalance Netting Process, a Cross-Border FRR Activation Process or a Cross-Border RR Activation Process in accordance with Section 4.10, paragraph (2);
- o) Requirements for availability, reliability and redundancy of the technical infrastructure in accordance with Section 4.12, paragraph (2);
- p) The common rules for the operation in Normal State and Alert State in accordance with Section 5.1, paragraph (6) and the actions defined in accordance with Section 5.1, paragraph (15);

¹ The netted sum of electricity exports and imports AC-only for each market time unit for a bidding zone, used in the Common Grid Model Alignment (excluding HVDC exports and imports).

- q) If applicable for a Synchronous Area, limits for the Exchange of FCR between the TSOs in accordance with Section 9.1.1, paragraph (2);
- r) The roles and responsibilities of the Reserve Connecting TSO, the Reserve Receiving TSO and the Affected TSO for the Exchange of FRR and RR defined in accordance with Section 9.1.3, paragraph (1);
- s) The roles and responsibilities of the Control Capability Providing TSO, the Control Capability Receiving TSO and the Affected TSO for the Sharing of FRR and RR defined in accordance with Section 9.1.4, paragraph (1);
- t) The roles and responsibilities of the Reserve Connecting TSO, the Reserve Receiving TSO and the Affected TSO for the Exchange of Reserves between Synchronous Areas, and of the Control Capability Providing TSO, the Control Capability Receiving TSO and the Affected TSO for the Sharing of Reserves between Synchronous Areas defined in accordance with Section 9.2.1, paragraph (2);
- u) The methodology to determine limits on the amount of Exchange of FCR between Synchronous Areas defined in accordance with Section 9.2.2, paragraph (1);
- v) The methodology to determine limits on the amount of Exchange of FRR between Synchronous Areas defined in accordance with Section 9.2.5, paragraph (1) and the methodology to determine limits on the amount of Sharing of FRR between Synchronous Areas defined in accordance with Section 9.2.6, paragraph (1); and
- w) The methodology to determine limits on the amount of Exchange of RR between Synchronous Areas defined in accordance with Section 9.2.7, paragraph (1) and the methodology to determine limits on the amount of Sharing of RR between Synchronous Areas defined in accordance with Section 9.2.8, paragraph (1).

2.2 LFC Block Operational Agreement

By [date – 12 months after entry into force], all TSOs of each LFC Block shall establish a LFC Block Operational Agreement that shall at least include:

- a) Whenever the LFC Block consists of more than one LFC Area, FRCE Target Parameters for each LFC Area within the LFC Block defined in accordance with Section 3.2, paragraph (3);
- b) The appointment of a LFC Block Monitor in accordance with Section 3.6, paragraph (1);
- c) Ramping restrictions for Active Power Output in accordance with Section 3.10;
- d) Whenever the LFC Block is operated by more than one TSO, the specific allocation of responsibilities between TSOs within the LFC Block in accordance with Section 4.3, paragraph (9);
- e) If applicable, the appointment of the TSO responsible for the tasks in Section 4.5, paragraph (6);
- f) The definition of the methodology to limit the amount of FRR or RR Capacity that can be made available for the Cross-Border FRR or RR Activation Process in accordance with Section 4.8, paragraph (7) and Section 4.9, paragraph (7);
- g) Additional requirements for the availability, reliability and redundancy of the technical infrastructure defined in accordance with Section 4.12, paragraph (3);

- h) Operational procedures for the case of exhausted FRR and RR in accordance with Section 5.1, paragraph (8);
- i) The FRR Dimensioning Rules defined in accordance with Section 7.1, paragraph (1);
- j) The RR Dimensioning Rules defined in accordance with Section 8.1, paragraph (2);
- k) Whenever the LFC Block is operated by more than one TSO, the specific allocation of responsibilities defined in accordance with Section 7.1, paragraph (3), and if applicable, the specific allocation of responsibilities defined in accordance with Section 8.1, paragraph (6);
- l) The escalation procedures defined in accordance with Section 7.1, paragraph (4) and if applicable the escalation procedures defined in accordance with Section 8.1, paragraph (7);
- m) The FRR Availability Requirements and the requirements on the control quality defined in accordance with Section 7.2, paragraph (2), and if applicable, the RR Availability Requirements and the requirements on the control quality defined in accordance with Section 8.2, paragraph (2);
- n) If applicable, any limits on the Exchange of FCR between the LFC Areas of LFC Blocks within the GMS Synchronous Area and the Exchange of FRR or RR between the LFC Areas of a LFC Block of a Synchronous Area consisting of more than one LFC Block defined in accordance with Section 9.1.1, paragraph (2), Section 9.1.5 and Section 9.1.7, paragraph (2);
- o) The roles and the responsibilities as the Reserve Connecting TSO, the Reserve Receiving TSO and the Affected TSO for the Exchange of FRR and/or RR with TSOs of other LFC Blocks defined in accordance with Section 9.1.3, paragraph (6);
- p) The roles and the responsibilities as the Control Capability Providing TSO, the Control Capability Receiving TSO and the Affected TSO for the Sharing of FRR and/or RR defined in accordance with Section 9.1.4, paragraph (7);
- q) Roles and responsibilities as the Control Capability Providing TSO, the Control Capability Receiving TSO and the Affected TSO for the Sharing of FRR and RR between Synchronous Areas in accordance with Section 9.2.4, paragraph (2);
- r) Coordination actions aiming to reduce the FRCE as defined in Section 5.1, paragraph (14); and
- s) Measures to reduce the FRCE by requiring changes in the Active Power production or consumption of Power Generating Modules and Demand Units in accordance with Section 5.1, paragraph (16).

2.3 LFC Area Operational Agreement

By [date – 12 months after entry into force], all TSOs of each LFC Area shall establish a LFC Area Operational Agreement that shall at least include:

- a) The specific allocation of responsibilities between TSOs within the LFC Area according to Section 4.3, paragraph (8); and
- b) The TSO responsible for the implementation and operation of the Frequency Restoration Process according to Section 4.5, paragraph (7).

2.4 Monitoring Area Operational Agreement

By [date – 12 months after entry into force], all TSOs of each Monitoring Area shall establish a Monitoring Area Operational Agreement that shall at least include:

- a) The specific allocation of responsibilities between TSOs within the Monitoring Area according to Section 4.3, paragraph (7).

2.5 Imbalance Netting Agreement

All TSOs participating in the same Imbalance Netting Process shall establish an Imbalance Netting Agreement that shall at least include:

- a) The roles and responsibilities of the TSOs according to Section 4.10, paragraph (3).

2.6 Cross-Border FRR Activation Agreement

All TSOs participating in the same Cross-Border FRR Activation Process shall establish a Cross-Border FRR Activation Agreement that shall at least include:

- a) The roles and responsibilities of the TSOs according to Section 4.10, paragraph (3).

2.7 Cross-Border RR Activation Agreement

All TSOs participating in the same Cross-Border RR Activation Process shall establish a Cross-Border RR Activation Agreement that shall at least include:

- a) The roles and responsibilities of the TSOs according to Section 4.10, paragraph (3).

2.8 Sharing Agreement

All TSOs participating in the same Sharing of FCR, FRR or RR shall establish a Sharing Agreement that shall at least include:

- a) In case of the Sharing of FRR or RR within the Synchronous Area, the roles and responsibilities of the Control Capability Receiving TSO and the Control Capability Providing TSO and the Affected TSOs according to Section 9.1.4, paragraph (3); or
- b) In case of the Sharing of Reserves between Synchronous Areas, the roles and responsibilities of the Control Capability Receiving TSO and the Control Capability Providing TSO according to Section 9.2.1, paragraph (4) and the procedures in case the Sharing of Reserves between Synchronous Areas fails in real-time according to Section 9.2.1, paragraph (9).

2.9 Exchange Agreement

All TSOs participating in the same Exchange of FCR, FRR or RR shall establish an Exchange Agreement that shall at least include:

- a) In case of the Exchange of FRR or RR within the Synchronous Area the roles and responsibilities of the Reserve Connecting and Reserve Receiving TSOs according to Section 9.1.3, paragraph (3); or
- b) In case of the Exchange of Reserves between Synchronous Areas the roles and responsibilities of the Reserve Connecting and Reserve Receiving TSOs according to Section 9.2.1, paragraph (4) and the procedures in case the Exchange of Reserves between Synchronous Areas fails in real-time according to Section 9.2.1, paragraph (9).

3. Frequency Quality

3.1 Frequency Quality Target Parameters

- (1) The Frequency Quality Defining Parameters shall be:
 - a) the Nominal Frequency for all Synchronous Areas;
 - b) the Standard Frequency Range for all Synchronous Areas;
 - c) the Maximum Instantaneous Frequency Deviation for all Synchronous Areas;
 - d) the Maximum Steady-State Frequency Deviation for all Synchronous Areas;
 - e) the Time to Restore Frequency for all Synchronous Areas; and
 - f) the Alert State Trigger Time for all Synchronous Areas.
- (2) The Nominal Frequency shall be 50Hz for all Synchronous Areas.
- (3) The default values of the Frequency Quality Defining Parameters listed in Section 3.1, paragraph (1) shall be the values given in the Table below.

FREQUENCY QUALITY DEFINING PARAMETERS	
Standard Frequency Range	±50 mHz
Maximum Instantaneous Frequency Deviation	800 mHz
Maximum Steady-state Frequency Deviation	200 mHz
Time to Restore Frequency	15 minutes
Alert State Trigger Time	5 minutes

Table 3-1 – Frequency Quality Defining Parameters of the Synchronous Areas

- (4) The Frequency Quality Target Parameter shall be the target maximum number of minutes outside the Standard Frequency Range per year per Synchronous Area, and its default value per Synchronous Area shall be the value given in the Table below.

FREQUENCY QUALITY TARGET PARAMETERS	
Maximum number of minutes outside the Standard Frequency Range	15 000

Table 3-2 - Frequency Quality Target Parameters of the Synchronous Area

- (5) The Frequency Quality Defining Parameters (3) above and the Frequency Quality Target Parameter (4) above shall have the default values unless all TSOs of a Synchronous Area agree on modified values in accordance with (6) below.
- (6) All TSOs of a Synchronous Area shall have the right to define, in the Synchronous Area Operational Agreement, modified values of the Frequency Quality Defining

Parameters (3) or the Frequency Quality Target Parameter (4) based on an assessment of the historical values of the System Frequency and the Synchronous Area development in case the following conditions are met:

- a) the proposed modification of the Frequency Quality Defining Parameter (3) or the Frequency Quality Target Parameter (4) takes into account:
 - i. system size based on consumption and generation of the Synchronous Area and Inertia of the Synchronous Area;
 - ii. the Reference Incident;
 - iii. grid structure and/or network topology;
 - iv. load and generation behaviour;
 - v. number and response of Power Generating Modules with Limited Frequency Sensitive Mode as defined in the [GMS Connection Network Code, Chapter 2 “Requirements for Generators” (RfG), Section 2.2], and of Demand Units operating with activated Demand Side Response System Frequency Control as defined in the [GMS Connection Network Code, Chapter 4 “Demand Connection”]; and
 - vi. the capabilities of Power Generating Modules and Demand Facilities;
- b) the impact on stakeholders is investigated through consultation.

3.2 FRCE Target Parameters

- (1) All TSOs of the GMS Synchronous Areas shall define in the Synchronous Area Operational Agreement the values of the Level 1 FRCE Range and the Level 2 FRCE Range for each LFC Block of the Synchronous Area at least every year, with the goal of respecting the provisions of Section 3.1.

The TSOs of the GMS Synchronous Areas, if consisting of more than one LFC Block, shall ensure that the Level 1 FRCE Ranges and the Level 2 FRCE Ranges of the LFC Blocks of their Synchronous Area are proportional to the square root of the sum of the Initial FCR Obligations according to Section 6.1 of the TSOs constituting the LFC Blocks.

- (2) The TSOs of the GMS Synchronous Areas shall use the following FRCE Target Parameters for each LFC Block of their Synchronous Area:
 - a) the number of time intervals per year outside the Level 1 FRCE Range within a time interval equal to the Time to Restore Frequency shall be less than 30% of the time intervals of the year; and
 - b) the number of time intervals per year outside the Level 2 FRCE Range within a time interval equal to resolution the Time to Restore Frequency shall be less than 5% of the time intervals of the year.
- (3) Where a LFC Block consists of more than one LFC Area, all TSOs of the LFC Block shall define, in the LFC Block Operational Agreement, the values of the Level 1 and Level 2 FRCE Ranges and of the FRCE Target Parameters for each LFC Area complying with Section 3.2, paragraph (1).

3.3 Criteria Application Process and Frequency Quality Evaluation Criteria

- (1) The Criteria Application Process shall comprise:
 - a) the collection of Frequency Quality Evaluation Data; and

- b) the calculation of Frequency Quality Evaluation Criteria.
- (2) The Frequency Quality Evaluation Criteria shall comprise:
- a) for the Synchronous Area, for operation in Normal State or Alert State as defined by [GMS Network Code on Operational Security – OS, Section 2.1 “System States”] for a 1-month period for the Instantaneous Frequency Data:
- i. the mean value;
 - ii. the standard deviation;
 - iii. the 1-, 5-, 10-, 90-, 95- and 99-percentile;
 - iv. the total time in which the absolute value of the Instantaneous Frequency Deviation was larger than the Standard Frequency Deviation, separate for negative and positive Instantaneous Frequency Deviations;
 - v. the total time in which the absolute value of the Instantaneous Frequency Deviation was larger than the Maximum Instantaneous Frequency Deviation, separate for negative and positive Instantaneous Frequency Deviations;
 - vi. the number of events for which the absolute value of the Instantaneous Frequency Deviation of the Synchronous Area exceeded 200% of the Standard Frequency Deviation and the Instantaneous Frequency Deviation was not returned to 50% of the Standard Frequency Deviation within the time to restore frequency;

- b) for the LFC Blocks of the GMS Synchronous Areas, for operation in Normal State or Alert State as defined by [GMS Network Code on Operational Security – OS, Section 2.1 “System States”] for a 1-month period:

For a data-set containing the average values of the FRCE of the LFC Block for time intervals with a length equal to the Time to Restore Frequency:

- i. the mean value;
- ii. the standard deviation;
- iii. the 1-, 5-, 10-, 90-, 95- and 99-percentile;
- iv. the number of time intervals for which the average value of the FRCE was outside the Level 1 FRCE Range, separate for negative and positive FRCE;
- v. the number of time intervals for which the average value of the FRCE was outside the Level 2 FRCE Range, separate for negative and positive FRCE;

For a data-set containing the average values of the FRCE of the LFC Block over time intervals with a length of one minute:

The number of events within a 1-month period for which FRCE exceeded 60% of the FRR Capacity and was not returned to 15% of the FRR Capacity within the Time to Restore Frequency, separate for negative and positive FRCE.

- (3) The TSOs of each Synchronous Area shall define, in the Synchronous Area Operational Agreement, a common methodology to assess the risk and the evolution of the risk of FCR Exhaustion of the Synchronous Area. This methodology shall be performed at least on an annual basis and shall be based at least on historical System Frequency data. The TSOs of each Synchronous Area shall provide the required input data for this analysis.

3.4 Data Collection and Delivery Process

- (1) The Data Collection and Delivery Process shall comprise the following:
 - a) measurements of the System Frequency;
 - b) calculation of the Frequency Quality Evaluation Data; and
 - c) delivery of the Frequency Quality Evaluation Data for the Criteria Application Process.
- (2) The Frequency Quality Evaluation Data shall be:
 - a) for the Synchronous Area:
 - i. the Instantaneous Frequency Data; and
 - ii. the Instantaneous Frequency Deviation Data;
 - b) for each LFC Block of the Synchronous Area the Instantaneous FRCE Data.
- (3) The measurement accuracy of the Instantaneous Frequency Data and of the Instantaneous FRCE (if measured in Hz) shall be 1 mHz or better.

3.5 Synchronous Area Monitor

- (1) All TSOs of a Synchronous Area shall appoint one TSO of the Synchronous Area in the Synchronous Area Operational Agreement as the Synchronous Area Monitor.
- (2) The Synchronous Area Monitor shall implement the Data Collection and Delivery Process of the Synchronous Area as defined in accordance with Section 3.4.
- (3) The Synchronous Area Monitor shall implement the Criteria Application Process as defined in accordance with Section 3.3.

The Synchronous Area Monitor shall collect the Frequency Quality Evaluation Data regarding the Synchronous Area and perform the Criteria Application Process including the calculation of Frequency Quality Evaluation Criteria, during a 3-month period within 3 months from the time stamp of the last value of the Frequency Quality Evaluation Data.

3.6 LFC Block Monitor

- (1) All TSOs of a LFC Block shall appoint a TSO of this LFC Block, in the LFC Block Operational Agreement, as LFC Block Monitor for the LFC Block.
- (2) The LFC Block Monitor shall collect the Frequency Quality Evaluation Data for the LFC Block in accordance with the Criteria Application Process in accordance with Section 3.3.
- (3) Each TSO of a LFC Area shall provide its LFC Block Monitor with the necessary LFC Area measurements needed for collecting Frequency Quality Evaluation Data for the LFC Block.
- (4) The LFC Block Monitor shall deliver the Frequency Quality Evaluation Data regarding the LFC Block and its LFC Areas during a 3-month period to the Synchronous Area Monitor within 2 months from the time stamp of the last value of the Frequency Quality Evaluation Data.

3.7 Information on Load and Generation Behaviour

In accordance with Section 3.1 “Data Exchange – General Requirements”, paragraphs (3) and (4) of [GMS Network Code on Operational Security – OS], each Connecting TSO shall have the right to request the information necessary from Significant Grid Users as defined in [GMS Network Code on Operational Security – OS], Section 1.1, paragraph (4) to monitor the load and generation behaviour related to imbalances. This information may include:

- a) the time-stamped Active Power Setpoint for real-time and future operation; and
- b) the time-stamped total Active Power output.

3.8 Ramping Period for the Synchronous Area

All TSOs of each Synchronous Area with more than one LFC Area shall define, in the Synchronous Area Operational Agreement, rules for the calculation of the Control Program from the Netted Area AC Position with a common Ramping Period for ACE calculation.

3.9 Ramping Restriction for Active Power Output on Synchronous Area Level

In accordance with Section 2.2, paragraph (14) of [GMS Network Code on Operational Security – OS], all TSOs of each Synchronous Area shall have the right to define, in the Synchronous Area Operational Agreement, restrictions for the Active Power output of HVDC Interconnectors between Synchronous Areas to limit their influence on the fulfilment of the Frequency Quality Target of the Synchronous Area by defining:

- a) a unique maximum Ramping Rate and/or a unique Ramping Period applicable to all individual HVDC Interconnectors; and/or
- b) a combined maximum Ramping Rate for all HVDC Interconnectors of the Synchronous Area.

The restrictions shall not apply for Active Power Reserves or Imbalance Netting Power Interchange.

3.10 Ramping Restriction for Active Power Output on LFC Block Level

- (1) In accordance with Section 2.2, paragraph (14) of [GMS Network Code on Operational Security – OS], all Connecting TSOs of an HVDC Interconnector in the same or in different Synchronous Areas shall have the right to define in the LFC Block Operational Agreement common restrictions for the Active Power output of this HVDC Interconnector to limit their influence on the fulfilment of the FRCE Target Parameter of the connected LFC Blocks by agreeing on Ramping Periods and/or maximum Ramping Rates for this HVDC Interconnector while respecting the provisions of Section 3.9. The restrictions shall not apply for Active Power Reserves or Imbalance Netting Power Interchange.
- (2) In accordance with Section 2.2, paragraph (14) of [GMS Network Code on Operational Security – OS], all TSOs of an LFC Block shall have the right to define in the LFC Block Operational Agreement and apply the following measures to support the fulfilment of the FRCE Target Parameter of the LFC Block:
 - a) definition of Ramping Periods and/or maximum Ramping Rates on Power Generating Modules and / or Demand Units;

- b) individual ramping starting times for Power Generating Modules and / or Demand Units within the LFC Block; and
 - c) coordination of the ramping between Power Generating Modules, Demand Units and Active Power consumption within the LFC Block.
- (3) The TSOs of a Synchronous Area shall co-ordinate the measures defined in Section 3.10, paragraph (2) within the Synchronous Area.

3.11 Mitigation

- (1) If the values calculated for the measurement period of one calendar year, the Frequency Quality Target Parameters or the FRCE Target Parameters are outside the set targets for the Synchronous Area or for the LFC Block, all TSOs of the relevant Synchronous Area or of the relevant LFC Block shall:
- a) perform a frequency investigation analysing if the Frequency Quality Target Parameters or the FRCE Target Parameters will remain outside the set targets for the Synchronous Area or for the LFC Block or if there is a justified expected risk for it, analyse the root causes and develop recommendations; and
 - b) decide on mitigation measures to ensure that the targets for the Synchronous Area or for the LFC Block can be met in the future.

4. Load-Frequency-Control Structure

4.1 Basic Structure

- (1) All TSOs of a Synchronous Area shall define, in the Synchronous Area Operational Agreement, the Load-Frequency-Control Structure for the Synchronous Area. Each TSO is responsible for implementing and operating according to the Load-Frequency Control Structure of its Synchronous Area.
- (2) The Load-Frequency Control Structure of each Synchronous Area shall include:
 - a) a Process Activation Structure according to Section 4.2 below; and
 - b) a Process Responsibility Structure according to Section 4.3 below.

4.2 Process Activation Structure

- (1) The Process Activation Structure shall include:
 - a) a FCP according to Section 4.4; and
 - b) a FRP according to Section 4.5.
- (2) The Process Activation Structure may include:
 - a) a RRP according to Section 4.6;
 - b) an Imbalance Netting Process according to Section 4.7;
 - c) a Cross-Border FRR Activation Process according to Section 4.8;
 - d) a Cross-Border RR Activation Process according to Section 4.9; and
 - e) a Time Control Process according to Section 10.1.
- (3) The Process Activation Structure of GMS shall include a Time Control Process according to Section 10.1.

4.3 Process Responsibility Structure

- (1) When defining the Process Responsibility Structure, all TSOs of a Synchronous Area shall take into account at least the following criteria:
 - a) size and the total Inertia and Synthetic Inertia of the Synchronous Area;
 - b) grid structure and/or network topology; and
 - c) load, generation and HVDC behaviour.
- (2) All TSOs of a Synchronous Area shall ensure that:
 - a) a Monitoring Area corresponds to or is part of only one LFC Area;
 - b) a LFC Area corresponds to or is part of only one LFC Block;
 - c) a LFC Block corresponds to or is part of only one Synchronous Area; and
 - d) each network element is part of only one Monitoring Area, only one LFC Area and only one LFC Block.
- (3) All TSOs of a Monitoring Area shall continuously calculate and monitor the real-time Active Power interchange of the Monitoring Area.
- (4) All TSOs of a LFC Area shall:

- a) continuously monitor the FRCE of the LFC Area;
 - b) implement and operate a FRP for the LFC Area;
 - c) make best endeavours to fulfil the FRCE Target Parameters of the LFC Area as defined in Section 3.2; and
 - d) have the right to implement one or several of the processes referred to in Section 4.2, paragraph (2).
- (5) All TSOs of a LFC Block shall:
- a) make best endeavours to fulfil the FRCE Target Parameters of the LFC Block as defined in Section 3.2; and
 - b) comply with the FRR Dimensioning Rules established in Section 7.1 and the RR Dimensioning Rules established in Section 8.1.
- (6) All TSOs of a Synchronous Area shall:
- a) implement and operate a FCP for the Synchronous Area;
 - b) comply with FCR Dimensioning Rules established in Section 6.1; and
 - c) make best endeavours to fulfil the Frequency Quality Target Parameters as established in Section 3.1.
- (7) All TSOs of a Monitoring Area shall agree in a Monitoring Area Operational Agreement on the specific allocation of responsibilities between TSOs within the Monitoring Area for the implementation of the obligations established in Section 4.3, paragraph (3).
- (8) All TSOs of a LFC Area shall agree in a LFC Area Operational Agreement on the specific allocation of responsibilities between TSOs within the LFC Area for the implementation of the obligations established in Section 4.3, paragraph (4).
- (9) All TSOs of a LFC Block shall define in the LFC Block Operational Agreement on the specific allocation of responsibilities between TSOs within the LFC Block for the implementation of the obligations established in Section 4.3, paragraph (5).
- (10) All TSOs of a Synchronous Area shall define, in the Synchronous Area Operational Agreement, the specific allocation of responsibilities between TSOs within the Synchronous Area for the implementation of the obligations established in Section 4.3, paragraph (6).
- (11) All TSOs of two or more adjacent LFC Areas shall have the right to form a LFC Block if the requirements for the LFC Block set forth in this Network Code are fulfilled.

4.4 Frequency Containment Process (FCP)

- (1) The control target of FCP is to stabilize the System Frequency by activation of FCR.
- (2) The overall characteristic for FCR activation in a Synchronous Area shall reflect a monotonically decrease of the FCR activation as a function of the Frequency Deviation.

4.5 Frequency Restoration Process (FRP)

- (1) The control target of the FRP is to:
 - a) regulate the FRCE towards zero within the Time to Restore Frequency; and
 - b) for the GMS Synchronous Areas to progressively replace the activated FCR by activation of FRR.
- (2) The FRCE is:

- a) the Area Control Error (ACE) of a LFC Area where there are more than one LFC Area in a Synchronous Area; or
 - b) the Frequency Deviation where one LFC Area corresponds to the LFC Block and the Synchronous Area.
- (3) The ACE of a LFC Area shall be calculated as the sum of the product of the K-Factor of the LFC Area with the Frequency Deviation plus the subtraction of:
- a) the total Tie-Line and Virtual Tie-Line Active Power flow; and
 - b) the Control Program according to Section 3.8.
- (4) The Setpoint value for automated FRR activation shall be calculated by a single frequency restoration controller operated by a TSO within its LFC Area. The frequency restoration controller shall:
- a) be an automatic control device designed to reduce the FRCE to zero;
 - b) be operated in a closed-loop manner with FRCE as input and Setpoint value for FRR activation as output;
 - c) have proportional-integral behaviour; and
 - d) have a control algorithm which prevents the integral term of a proportional-integral controller from accumulating the control error and overshooting.
- (5) The Setpoint value for manual FRR activation shall be left to the discretion of the TSO for its LFC Area.
- (6) Without prejudice to Section 4.3, paragraph (4) and Section 4.5, when a LFC Block consists of more than one LFC Area, all TSOs of the LFC Block shall have the right to appoint one TSO of the LFC Block in the LFC Block Operational Agreement to:
- a) calculate and monitor the FRCE of the whole LFC Block; and
 - b) take the FRCE of the whole LFC Block into account for the calculation of the Setpoint value for FRR activation according to Section 4.5, paragraph (4) and Section 4.5, paragraph (5) in addition to the FRCE of the LFC Area.
- (7) Where a LFC Area consists of more than one Monitoring Area, all TSOs of the LFC Area shall appoint one TSO in a LFC Area Operational Agreement, who shall be responsible for the implementation and operation of the Frequency Restoration Process.
- (8) Without prejudice to Section 4.3, paragraph (4), where a LFC Area consists of more than one Monitoring Area, the Frequency Restoration Process of this LFC Area shall enable the control of the Active Power interchange of each Monitoring Area to a value determined as secure based on a real-time Operational Security Analysis.

4.6 Reserve Replacement Process (RRP)

- (1) The control target of the RRP is to fulfil one or several of the following goals:
- a) progressively restore the activated FRR; and
 - b) support FRR activation.
- (2) The Setpoint value for RR activation shall be determined by a TSO for its LFC Area.

4.7 Imbalance Netting Process

- (1) The control target of the Imbalance Netting Process is to reduce the amount of simultaneous counteracting FRR activation of different participating LFC Areas by Imbalance Netting Power Interchange. Each TSO shall have the right to implement the Imbalance Netting Process for LFC Areas within the same LFC Block, between different LFC Blocks or between different Synchronous Areas by concluding an Imbalance Netting Agreement.
- (2) The Imbalance Netting Process shall be implemented in such a way that it does not affect:
 - a) the stability of the FCP of the Synchronous Area or Synchronous Areas involved in the Imbalance Netting Process;
 - b) the stability of the FRP and the RRP of each LFC Area operated by participating or Affected TSOs; and
 - c) the Operational Security.
- (3) The Imbalance Netting Power Interchange between LFC Areas of the same Synchronous Area shall be implemented by one or several of the following actions:
 - a) defining an Active Power flow over a Virtual Tie-Line which shall be part of the FRCE calculation; and/or
 - b) adjusting the Active Power flows over HVDC Interconnectors.
- (4) The Imbalance Netting Power Interchange between LFC Areas of different Synchronous Areas shall be implemented by adjusting the Active Power flows over HVDC Interconnectors.
- (5) The Imbalance Netting Power Interchange of a LFC Area shall be implemented in such a way that it does not exceed the actual amount of FRR activation that is necessary to regulate the FRCE of this LFC Area to zero without Imbalance Netting Power Interchange.
- (6) The Imbalance Netting Power Interchange between LFC Areas shall be implemented in such a way that it does not result in power flows that exceed Operational Security Limits.
- (7) All TSOs participating in the same Imbalance Netting Process shall ensure that the sum of all Imbalance Netting Power Interchanges is equal to zero.
- (8) The Imbalance Netting Process shall include a fall-back mechanism that shall:
 - a) ensure that the Imbalance Netting Power Interchange of each LFC Area is zero or limited to a value for which Operational Security can be guaranteed; and
 - b) comply with the requirements established in Section 4.7, paragraph (2).
- (9) Where a LFC Block consists of more than one LFC Area and the FRR Capacity as well as the RR Capacity is calculated based on the LFC Block Imbalances, all TSOs of the same LFC Block shall implement an Imbalance Netting Process and interchange the maximum amount of Imbalance Netting Power as defined in Section 4.7, paragraph (3) with other LFC Areas of the same LFC Block while complying with Section 4.7, paragraph (1).
- (10) Where an Imbalance Netting Process is implemented for LFC Areas of different Synchronous Areas, all TSOs shall interchange the maximum amount of Imbalance Netting Power as defined in Section 4.7, paragraph (5) with other TSOs of the same Synchronous Area participating in this Imbalance Netting Process while complying with Section 4.7, paragraph (9).

- (11) Where an Imbalance Netting Process is implemented for LFC Areas that are not part of the same LFC Block, all TSOs of the LFC Blocks involved shall be able fulfil the obligations established in Section 4.3, paragraph (5) regardless of Imbalance Netting Power Interchange.

4.8 Cross-Border FRR Activation Process

- (1) The control target of the Cross-Border FRR Activation Process is to enable a TSO to perform the FRP by Frequency Restoration Power Interchange between LFC Areas. Each TSO shall have the right to implement the Cross-Border FRR Activation Process for LFC Areas within the same LFC Block, between different LFC Blocks or between different Synchronous Areas by concluding a Cross-Border FRR Activation Agreement.
- (2) The Cross-Border FRR Activation Process shall be implemented in such a way that it does not affect:
- a) the stability of the FCP of the Synchronous Area or Synchronous Areas involved in the Cross-Border FRR Activation Process;
 - b) the stability of the FRP and the RRP of each LFC Area operated by participating or Affected TSOs; and
 - c) Operational Security.
- (3) The Frequency Restoration Power Interchange between LFC Areas of the same Synchronous Area shall be implemented by one or several of the following actions:
- a) defining an Active Power flow over a Virtual Tie-Line, which shall be part of the FRCE calculation, where FRR activation is automated;
 - b) adjusting a Control Program or defining an Active Power flow over a Virtual Tie-Line between LFC Areas, where FRR activation is manual; or
 - c) adjusting the Active Power flows over HVDC Interconnectors.
- (4) The Frequency Restoration Power Interchange between LFC Areas of different Synchronous Areas shall be implemented by adjustment of Active Power flows over HVDC Interconnectors.
- (5) The Frequency Restoration Power Interchange between LFC Areas shall be implemented in such a way that it does not result in power flows that exceed Operational Security Limits.
- (6) All TSOs participating in the same Cross-Border FRR Activation Process shall ensure that the sum of all Frequency Restoration Power Interchanges is equal to zero.
- (7) All TSOs of a LFC Block shall have the right to define a methodology to limit the amount of FRR Capacity that can be made available for the Cross-Border FRR Activation Process in the LFC Block Operational Agreement to ensure:
- a) the ability of the Synchronous Area to reach the Frequency Quality Targets or the ability of its LFC Block to reach the FRCE Quality Target in accordance with Section 3.1 and Section 3.2;
 - b) the ability of the TSOs of the LFC Block to have continuously access to the amount of FRR resulting from the FRR Dimensioning Processes in accordance with Section 7.1; and
 - c) the Operational Security.
- (8) The Cross-Border FRR Activation Process shall include a fall-back mechanism which shall:

- a) ensure that the Frequency Restoration Power Interchange of each LFC Area is zero or limited to a value for which Operational Security can be guaranteed; and
- b) comply with the requirements established in Section 4.8, paragraph (2).

4.9 Cross-Border RR Activation Process

- (1) The control target of the Cross-Border RR Activation Process is to enable a TSO to perform the RRP through Replacement Power Interchange between LFC Areas. Each TSO shall have the right to implement the Cross-Border RR Activation Process for LFC Areas within the same LFC Block, between different LFC Blocks or between different Synchronous Areas by concluding a Cross-Border RR Activation Agreement.
- (2) The Cross-Border RR Activation Process shall be implemented in such a way that it does not affect:
 - a) the stability of the FCP of the Synchronous Area or Synchronous Areas involved in the Cross-Border RR Activation Process;
 - b) the stability of the FRP and the RRP of each LFC Area operated by participating or Affected TSOs; and
 - c) Operational Security.
- (3) The Replacement Power Interchange between LFC Areas of the same Synchronous Area shall be implemented by one or several of the following actions:
 - a) defining an Active Power flow over a Virtual Tie-Line that shall be part of the FRCE calculation;
 - b) adjusting of a Control Program; or
 - c) adjusting of Active Power flows over HVDC Interconnectors
- (4) The Replacement Power Interchange between LFC Areas of different Synchronous Areas shall be implemented by adjustment of Active Power flows over HVDC Interconnectors.
- (5) The Replacement Power Interchange between LFC Areas shall be implemented in such a way that it does not result in power flows that exceed Operational Security Limits.
- (6) All TSOs participating in the same Cross-Border RR Activation Process shall ensure that the sum of all Replacement Power Interchanges is equal to zero.
- (7) All TSOs of an LFC Block shall have the right to define a methodology to limit the amount of RR Capacity that can be made available for the Cross-Border RR Activation Process in the LFC Block Operational Agreement to ensure:
 - a) the ability of the Synchronous Area to reach the Frequency Quality Targets or the ability of its LFC Block to reach the FRCE Quality Target in accordance with Section 3.1 and Section 3.2;
 - b) the ability of the TSOs of the LFC Block to have continuously access to the amount of FRR resulting from the RR Dimensioning Processes in accordance with Section 8.1; and
 - c) the Operational Security.
- (8) The Cross-Border RR Activation Process shall include a fall-back mechanism which shall:
 - a) ensure that the Replacement Power Interchange of each LFC Area is zero or limited to a value for which Operational Security can be guaranteed;

- b) comply with the requirements established in Section 4.9, paragraph (2).

4.10 General Requirements for Cross-Border Control Processes

- (1) All TSOs participating in an Exchange or Sharing of FRR shall implement a Cross-Border FRR Activation Process. All TSOs participating in an Exchange or Sharing of RR shall implement a Cross-Border RR Activation Process.
- (2) All TSOs of a Synchronous Area shall define in the Synchronous Area Operational Agreement the roles and the responsibilities of the TSOs implementing an Imbalance Netting Process, a Cross-Border FRR Activation Process or a Cross-Border RR Activation Process between LFC Areas of different LFC Blocks or of different Synchronous Areas.
- (3) All TSOs participating in the same Imbalance Netting Process shall define in an Imbalance Netting Agreement, all TSOs participating in the same Cross-Border FRR Activation Process shall define in a Cross-Border FRR Activation Agreement and all TSOs participating in the same Cross-Border RR Activation Process shall define in a Cross-Border RR Activation Agreement, the roles and responsibilities of the TSOs including but not limited to:
 - a) the provision of all input data necessary for:
 - i. calculation of power interchange with respect to the Operational Security Limits;
 - ii. real-time Operational Security Analysis by participating and Affected TSOs;
 - b) the responsibility to calculate the power interchange; and
 - c) the implementation of operational procedures to ensure Operational Security.
- (4) Without prejudice to Section 4.7, paragraph (9), Section 4.7, paragraph (10) and Section 4.7, paragraph (11) and as part of the multi-party agreements referred to in Section 4.10, paragraph (3), all TSOs participating in the same Imbalance Netting Process, Cross-Border FRR Activation Process or Cross-Border RR Activation Process shall have the right to define a sequential approach for calculation of the power interchange allowing any group of TSOs operating Adjacent LFC Areas or LFC Blocks to interchange Imbalance Netting, Frequency Restoration or Reserve Replacement Power among themselves ahead of interchange with other TSOs.
- (5) A TSO shall have the right to participate in more than one Imbalance Netting Process, Cross-Border FRR Activation Process or Cross-Border RR Activation Process only if:
 - a) there are no contradictions in the technical implementation agreed between the parties for each process;
 - b) the amounts for potential Imbalance Netting Power Interchange, Frequency Restoration Power Interchange and Reserve Replacement Power Interchange are clearly divided between the single processes; and
 - c) the overall Imbalance Netting Power Interchange, Frequency Restoration Power Interchange and Reserve Replacement Power Interchange of this TSO do not result in power flows violating Operational Security Limits.

4.11 TSO Notification

- (1) All TSOs willing to implement an Imbalance Netting Process, a Cross-Border FRR Activation, a Cross-Border RR Activation Process, Exchange of Reserves or Sharing of

Reserves shall send a notification to all TSOs of the Synchronous Area three months in advance. The notification shall include:

- a) involved TSOs;
 - b) expected amount of power interchange due to the Imbalance Netting Process, Cross-Border FRR Activation Process or Cross-Border RR Activation Process;
 - c) reserve type and amount of Exchange or Sharing of Reserves; and
 - d) time frame of Exchange or Sharing of Reserves.
- (2) Where an Imbalance Netting Process, a Cross-Border FRR Activation Process or a Cross-Border RR Activation Process is implemented for LFC Areas that are not parts of the same LFC Block, each TSO of the involved Synchronous Areas shall have the right to declare itself to all TSOs of the Synchronous Area as an Affected TSO based on Operational Security Analysis within one month after notification.
- (3) The Affected TSO shall have the right to:
- a) require the provision of real-time values for Imbalance Netting Power Interchange, Frequency Restoration Power Interchange and Replacement Power Interchange necessary for real-time Operational Security Analysis; and
 - b) require the implementation of an operational procedure enabling the Affected TSO to set limits for the Imbalance Netting Power Interchange, Frequency Restoration Power Interchange and Replacement Power Interchange between the respective LFC Areas based on Operational Security Analysis in real-time.

4.12 Infrastructure

- (1) All TSOs shall consider the technical infrastructure necessary to implement and operate one or more processes listed in Section 4.2 as critical according to [GMS Network Code on Operational Security – OS].
- (2) All TSOs of a Synchronous Area shall define, in the Synchronous Area Operational Agreement, minimum requirements for availability, reliability and redundancy of the technical infrastructure referred to in Section 4.12, paragraph (1) including but not limited to:
 - a) precision, resolution, availability and redundancy of Active Power flow and Virtual Tie-Line measurements;
 - b) availability and redundancy of digital control systems;
 - c) availability and redundancy of communication infrastructure; and
 - d) communication protocols.
- (3) All TSOs of a LFC Block shall define additional requirements for availability, reliability and redundancy of the technical infrastructure in the LFC Block Operational Agreement while complying with Section 4.12, paragraph (2).
- (4) Each TSO of a LFC Area shall:
 - a) ensure a sufficient quality and availability of the FRCE calculation;
 - b) perform real-time quality monitoring of the FRCE calculation;
 - c) take action in case of FRCE miscalculation; and
 - d) where the FRCE is defined by the ACE, perform an ex-post quality monitoring of the FRCE calculation by comparing FRCE to reference values at least on an annual basis.

5. Operation of Load-Frequency-Control

5.1 System States related to the System Frequency

- (1) All TSOs of a Synchronous Area shall establish a real-time data exchange, in accordance with Section 3.3 of [GMS Network Code on Operational Security – OS], of:
 - a) the System State of the Transmission System as defined in Section 2.1, “System States” of [GMS Network Code on Operational Security – OS]; and
 - b) the real-time measurement data of the FRCE of the LFC Blocks and LFC Areas of the Synchronous Area.
- (2) The Synchronous Area Monitor shall determine the System State with regard to the System Frequency in reference to Section 2.1, “System States” of [GMS Network Code on Operational Security – OS], according to the System Frequency limits defined in paragraphs (3) and (4) below.
- (3) The System Frequency limits for Normal State are fulfilled when:
 - a) the steady state System Frequency Deviation is within the Standard Frequency Range; or
 - b) the steady state System Frequency Deviation is not larger than 50 % of the Maximum Steady State Frequency Deviation for a time period not longer than the Time to Restore Frequency; or
 - c) the steady state System Frequency Deviation is not larger than the Maximum Steady State Frequency Deviation for a time period not longer than the Alert State Trigger Time.
- (4) The System Frequency limits for Alert State are fulfilled when:
 - a) the absolute value of the steady state System Frequency Deviation is not larger than the Maximum Steady State Frequency Deviation; and
 - b) the System Frequency limits for Normal State are not fulfilled.
- (5) The Synchronous Area Monitor shall ensure that all TSOs of all Synchronous Areas are informed in case the System Frequency Deviation fulfils one of the criteria for the Alert State.
- (6) The TSOs of a Synchronous Area shall define in the Synchronous Area Operational Agreement common rules for the operation of Load-Frequency Control in Normal State and Alert State.
- (7) The TSOs of a LFC Block shall reduce the FRCE of the LFC Block by activation of Active Power Reserves and if necessary by application of the actions as defined in (15) below.
- (8) The TSOs of a LFC Block shall define operational procedures for the case of exhausted FRR or RR in the LFC Block Operational Agreement. For these procedures the TSOs of a LFC Block shall have the right to require changes in the Active Power production or consumption of Power Generating Modules and Demand Units.
- (9) The TSOs of a LFC Block shall make reasonable endeavours to avoid FRCEs persisting for more than the Time to Restore Frequency.
- (10) For the case of an Alert State due to a violation of System Frequency limits, the TSOs of a Synchronous Area shall define, in the Synchronous Area Operational Agreement, operational procedures to reduce the System Frequency Deviation to restore the System State to Normal State and to limit the risk to enter into Emergency State. For these actions, the TSOs of the Synchronous Areas shall define procedures, in the

Synchronous Area Operational Agreement, for which the TSOs shall have the right to deviate from the obligation set in Section 4.5, paragraph (1).

- (11) In case of an Alert State due to there being insufficient Active Power Reserves according to Section 2.1, "System States" of [GMS Network Code on Operational Security – OS], to meet the requirements of the TSOs of those LFC Blocks, the TSOs shall in close cooperation with the other TSOs of the Synchronous Area and TSOs of other Synchronous Areas act to restore and replace necessary levels of Active Power Reserves. For this purpose the TSOs of a LFC Block shall have the right to require changes in the Active Power production or consumption of Power Generating Modules or Demand Units within its area with the aim to reduce or to eliminate the violation of Active Power Reserve requirements.
- (12) For the case the 1-minute average of the FRCE of a LFC Block is above the Level 2 FRCE Range for at least the Time to Restore Frequency and in case the FRCE is not expected to be reduced sufficiently by the actions defined in (15) below, the TSOs of a LFC Block shall have the right to require changes in the Active Power production or consumption of Power Generating Modules and Demand Units within its area with the aim to reduce the FRCE as defined in (16).
- (13) For the GMS Synchronous Areas, for the case the FRCE of a LFC Block exceeds 25 % of the Reference Incident of the Synchronous Area for more than 30 consecutive minutes and in case the FRCE is not expected to be reduced sufficiently by the actions defined in (15), the TSOs of a LFC Block shall require changes in the Active Power production or consumption of Power Generating Modules and Demand Units within its area with the aim to reduce the FRCE as defined in (16).
- (14) The LFC Block Monitor shall determine any violation of the limits referred to in (12) and (13) above in the case that these referenced clauses apply in the LFC Block. In these cases:
 - a) the LFC Block Monitor shall inform the other TSOs of the LFC Block; and
 - b) the TSOs of the LFC Block shall take coordinated actions aiming to reduce the FRCE. The TSOs of the LFC Block shall define these coordinated actions in the LFC Block Operational Agreement.
- (15) For the cases as specified in (10) to (13) above, the TSOs of a Synchronous Area shall define in the Synchronous Area Operational Agreement actions to enable the TSOs of a LFC Block to actively reduce the Frequency Deviation by cross-border activation of reserves. In case of an occurrence of these cases, the TSOs of the Synchronous Area shall make reasonable endeavours to enable the TSOs of the concerned LFC Block to reduce its FRCE.
- (16) The TSOs of a LFC Block shall define in the LFC Block Operational Agreement measures to reduce the FRCE by requiring changes in the Active Power production or consumption of Power Generating Modules and Demand Units within its area.

6. Frequency Containment Reserves (FCR) (or Primary Reserves)

6.1 FCR Dimensioning

- (1) All TSOs of a Synchronous Area shall determine the FCR Capacity required for the Synchronous Area and the shares of FCR required for each TSO as the Initial FCR Obligation according to Section 6.1, paragraphs (4), (5) and (6).
- (2) All TSOs of the GMS Synchronous Areas shall define in the Synchronous Area Operational Agreement and shall apply a dimensioning approach in accordance with Section 6.1, paragraph (5) for FCR based on a risk assessment criterion taking into account the pattern of load, generation and Inertia and Synthetic Inertia.
- (3) All TSOs of a Synchronous Area shall recalculate the FCR Capacity required for the Synchronous Area and the Initial FCR Obligation for each TSO at least on an annual basis in accordance with Section 6.1, paragraphs (4), (5) and (6).
- (4) All TSOs of the Synchronous Area shall have the right to recalculate the FCR Capacity required for the Synchronous Area and the Initial FCR Obligation for each TSO more frequently than on an annual basis. All TSOs of a Synchronous Area shall define in the Synchronous Area Operational Agreement dimensioning rules respecting the following criteria:
 - a) the FCR Capacity required for the Synchronous Area shall at least cover the Reference Incident of the Synchronous Area, based on a deterministic analysis and respecting the Frequency Quality Defining Parameters; and
 - b) for the GMS Synchronous Areas, all TSOs of a Synchronous Area shall define a dimensioning approach for FCR on the basis of the principle of covering remaining imbalances in the Synchronous Area that are likely to happen according to a probability of once in 20 years.
- (5) The TSOs of a Synchronous Area shall determine the size of the Reference Incident respecting the following conditions: the Reference Incident shall be the absolute value of the largest imbalance that may result from an instantaneous change of Active Power of one or two Power Generating Modules or one or two HVDC Interconnectors connected to the same electrical node or the maximum instantaneous loss of Active Power consumption due to the tripping of one or two Connections Points.
- (6) The shares of the FCR Capacity required for each TSO as Initial FCR Obligation shall be based on the sum of the net generation and consumption of its area divided by the sum of net generation and consumption of the Synchronous Area over a period of one year.

6.2 FCR Technical Minimum Requirements

- (1) Each Reserve Connecting TSO shall ensure that the FCR corresponds to the following properties listed for its Synchronous Area applying to all FCR Providing Units and FCR Providing Groups consistent with the values in [GMS Connection Network Code, Chapter 2, "Requirements for Generators – RfG", Section 2.2] in the Table below:

FCR Properties in the GMS Synchronous Areas	
Minimum accuracy of frequency measurement	10 mHz or the industrial standard if better

Maximum combined effect of inherent Frequency Response Insensitivity and possible intentional Frequency Response Dead band of the governor of the FCR Providing Units or FCR Providing Groups	10 mHz
FCR Full Activation Time	30 s
FCR Full Activation Frequency Deviation	±200 mHz

Table 6-1 – FCR Properties in the GMS Synchronous Areas

(2) All TSOs of a Synchronous Area shall have the right to define, in the Synchronous Area Operational Agreement, common additional properties of the FCR required to ensure Operational Security in the Synchronous Area by means of a set of technical parameters and within the ranges described in [GMS Connection Network Code, Chapter 2, “Requirements for Generators – RfG”, Section 2.2, and Chapter 4, “Demand Connection”]. These properties of FCR shall take into account the installed capacity, structure and pattern of consumption and generation of the Synchronous Area. For the introduction of additional properties a transition period upon consultation with affected FCR Providers shall be foreseen.

(3) The Reserve Connecting TSO shall have the right to define additional requirements for FCR Providing Groups within the ranges described in the [GMS Connection Network Code, Chapter 2, “Requirements for Generators – RfG”, Section 2.2, and Chapter 4, “Demand Connection”] based on technical arguments such as the geographical distribution of the Power Generating Modules or Demand Units establishing an FCR Providing Group to ensure Operational Security. The FCR Provider shall ensure that monitoring of the FCR activation of the FCR Providing Units within a Reserve Providing Group is possible.

The Reserve Connecting TSO shall have the right to exclude FCR Providing Groups from the provision of FCR based on technical arguments such as the geographical distribution of the Power Generating Modules or Demand Units establishing an FCR Providing Group to ensure Operational Security.

(4) Each FCR Providing Unit and each FCR Providing Group shall only have one Reserve Connecting TSO.

(5) Each Reserve Connecting TSO shall implement a FCR Prequalification to assess the fulfilment of the technical and Availability Requirements by potential FCR Providing Units or FCR Providing Groups. This process shall include at least a reassessment in case requirements or equipment change and a periodical reassessment within the time frame of at least five years. A potential FCR Provider shall have the right to apply for a Prequalification of potential FCR Providing Units or FCR Providing Groups at a relevant Reserve Connecting TSO. In case compliance with certain requirements of this code has already been verified against the Reserve Connecting TSO, it will be recognised in the Prequalification.

The Prequalification shall consist of the submission of the formal application of the potential FCR Provider including all required information to the Reserve Connecting TSO, the evaluation of the provided information by the Reserve Connecting TSO, the announcement of the respective findings including the possibility for the FCR Provider to amend the provided information within a defined period of time and the acceptance or refusal of the application by the Reserve Connecting TSO.

The Reserve Connecting TSO shall process the application within 3 months after provision of all the required information by the FCR Provider to the Reserve Connecting TSO and shall prequalify FCR Providing Units or FCR Providing Groups which successfully passed a FCR Prequalification.

- (6) Each FCR Providing Unit and each FCR Providing Group shall comply with the required properties for FCR according to Section 6.2, paragraphs (1) and (2) and shall activate the agreed FCR in accordance to Section 6.2, paragraphs (1) and (2) by means of a proportional governor reacting to frequency deviations or alternatively based on a monotonic piecewise linear power-frequency characteristic in the case of relay activated FCR.
- (7) Each Reserve Connecting TSO shall ensure that the activation of its FCR Providing Units or FCR Providing Groups is in line with the requirements of the Synchronous Area according to Section 6.2, paragraphs (1), (2) and (3).
- (8) Each Reserve Connecting TSO shall monitor its contribution to the FCP and its FCR activation with respect to its FCR Obligation including FCR Providing Units and FCR Providing Groups. Each FCR Provider shall make available to the Reserve Connecting TSO for each of its FCR Providing Units and FCR Providing Groups at least the following information:
 - a) Time-stamped status indicating if FCR is on or off.
 - b) Time-stamped Active Power data needed to verify FCR activation. This data shall include, but is not limited to time-stamped instantaneous Active Power.
 - c) Droop of the governor for Type C and Type D Power Generating Modules as defined in the [GMS Connection Network Code, Chapter 2, "Requirements for Generators – RfG"], acting as FCR Providing Units or its equivalent parameter for FCR Providing Groups consisting on Type A and/or Type B Power Generating Modules as defined in [GMS Connection Network Code, Chapter 2, "Requirements for Generators – RfG"] and/or Demand Unit with Demand Side Response Active Power Control as defined in [GMS Connection Network Code, Chapter 4, "Demand Connection"].

Each FCR Provider shall have the right to aggregate the respective data for its FCR Providing Units under the condition that the maximum power of the aggregated units is below 1.5 MW and clear verification of activation of FCR is possible.

At the request of the Reserve Connecting TSO, a FCR Provider has to make this information available in real time with a time resolution of at least 10 seconds.

At the request of the Reserve Connecting TSO, a FCR Provider has to make available data for technical installations that are part of the same FCR Providing Unit in case it is necessary for clear verification of activation of FCR.

6.3 FCR Provision

- (1) Each TSO shall ensure the availability of at least its FCR Obligation agreed upon in accordance with Section 6.1, paragraph (6), Section 9.1.1, Section 9.2.2 and Section 9.2.3.
- (2) The TSOs of a Synchronous Area shall determine, at least on an annual basis, the size of the K-Factor of the Synchronous Area taking into account factors including, but not limited to:
 - a) The FCR Capacity divided by the Maximum Steady-State Frequency Deviation;
 - b) the auto-control of generation; and

- c) the self-regulation of load taking into account the contribution according to the [GMS Connection Network Code, Chapter 4, "Demand Connection"].
- (3) The shares of the K-Factor for each TSO shall be based on:
- a) its Initial FCR Obligation according to (1) above of its area divided by the FCR Capacity; and
 - b) the amount of FCR Capacity from FCR Providing Units and FCR Providing Groups with a Connection Point inside the LFC Area.
- (4) A FCR Provider shall guarantee the continuous availability of FCR with the exception of a Forced Outage of a FCR Providing Unit during the time period in which it is obliged to provide FCR.

Each FCR Provider shall inform its Reserve Connecting TSO about any changes in actual availability of its FCR Providing Unit or its FCR Providing Group or a part of its FCR Providing Group that is considered to be relevant according to the results of Prequalification without undue delay.

- (5) Each TSO shall ensure, or shall require from its FCR Providers to ensure that the loss of a FCR Providing Unit does not endanger the System Security by:
- a) limiting the share of the FCR provided per FCR Providing Unit to 5 % of the FCR Capacity required for the Synchronous Area for CE; and
 - b) replacing the FCR that is made unavailable due to an Forced Outage or an unavailability of a FCR Providing Unit or FCR Providing Group as soon as technically possible and according to the conditions that shall be defined by the Reserve Connecting TSO.
- (6) A FCR Providing Unit or FCR Providing Group:
- a) with an energy reservoir that does not limit the FCR providing capability, shall activate its FCR as long as the Frequency Deviation persists;
 - b) with an energy reservoir that limits the FCR providing capability, shall activate its FCR as long as the Frequency Deviation persists unless its energy reservoir is exhausted in either direction.

For the GMS Synchronous Areas, a FCR Providing Unit or FCR Providing Group with an energy reservoir that limits the FCR providing capability, shall be able to fully activate its FCR continuously for a time period of not less than 30 minutes and for an equivalent longer time period in case of Frequency Deviations smaller than the FCR Full Activation Frequency Deviation and shall specify the limitations of the energy reservoir in the Prequalification.

An FCR Provider using FCR Providing Units or FCR Providing Group with an energy reservoir that limits the FCR providing capability shall take appropriate measures to ensure recovery of energy reservoirs in any of the two directions as soon as possible but at the latest within 2 hours.

7. Frequency Restoration Reserves (FRR) (or Secondary Reserves)

7.1 FRR Dimensioning

- (1) All TSOs of a LFC Block shall define, in the LFC Block Operational Agreement, FRR Dimensioning Rules.
- (2) The FRR Dimensioning Rules shall comprise at least the following requirements:
 - a) All TSOs of a LFC Block in the GMS Synchronous Areas shall determine the required FRR Capacity of the LFC Block based on consecutive historical records at least comprising historical LFC Block Imbalance values. The sampling of these historical records shall be at least the Time to Restore Frequency. The considered time period of these records shall be representative and include at least one full year period ending not earlier than 6 months prior to the calculation.
 - b) All TSOs of a LFC Block in the GMS Synchronous Areas shall determine the FRR Capacity of the LFC Block such that it is sufficient to respect the current FRCE Target Parameters in accordance with Section 3.2 for the considered historical period of time based at least on a probabilistic methodology. In this methodology, restrictions due to agreements for the Sharing or Exchange of Reserves due to possible violations of Operational Security and the FRR Availability Requirements shall be taken into account. All TSOs of a LFC Block shall take expected significant changes to the distribution of LFC Block Imbalances or other relevant influencing factors relative to the considered time period into account for this determination.
 - c) All TSOs of a LFC Block shall determine the ratio of Automatic FRR Capacity, manual FRR Capacity, the Automatic FRR Full Activation Time and manual FRR Full Activation Time such that requirement (b) above can be fulfilled. For this the Automatic FRR Full Activation Time of a LFC Block and the Manual FRR Full Activation Time of the LFC Block shall at most be the Time to Restore Frequency.
 - d) The TSOs of a LFC Block shall determine the size of the Dimensioning Incident. The Dimensioning Incident shall be the largest imbalance that may result from an instantaneous change of active power of a single Power Generating Module, single Demand Facility, and single HVDC interconnector or from a tripping of an AC-Line within the LFC Block.
 - e) All TSOs of a LFC Block shall determine the positive FRR Capacity such that it is not smaller than the positive Dimensioning Incident of the LFC Block.
 - f) All TSOs of a LFC Block shall determine the negative FRR Capacity such that it is not smaller than the negative Dimensioning Incident of the LFC Block.
 - g) All TSOs of a LFC Block shall determine the FRR Capacity of a LFC Block and possible geographical limitations for its distribution within the LFC Block and possible geographical limitations for any Exchange of Reserves or Sharing of Reserves with other LFC Blocks to respect the Operational Security.
 - h) All TSOs of a LFC Block shall ensure that the positive FRR Capacity or a combination of FRR and RR Capacity is sufficient to cover the positive LFC Block Imbalances in at least 99 % of the time based on the historical record as defined in (a) above.
 - i) All TSOs of a LFC Block shall ensure that the negative FRR Capacity or a combination of FRR and RR Capacity is sufficient to cover the negative LFC

Block Imbalances in at least 99 % of the time based on the historical record as defined in (a).

- j) All TSOs of a LFC Block are allowed to reduce the positive FRR Capacity of the LFC Block, resulting from the FRR Dimensioning Process, by concluding a FRR Sharing Agreement with other LFC Blocks in accordance with the provisions of Chapter 9. The reduction of the positive FRR Capacity of a LFC Block is:
 - i. limited to the difference, if positive, between the size of the positive Dimensioning Incident and the FRR Capacity required to cover the positive LFC Block imbalances in 99 % of time based on historical records as defined in (a) above; and
 - ii. shall never exceed 30 % of the size of the positive Dimensioning Incident.
 - k) All TSOs of a LFC Block are allowed to reduce the negative FRR Capacity of the LFC Block, resulting from the FRR Dimensioning Process, by concluding a FRR Sharing Agreement with other LFC Blocks in accordance with the provisions of Chapter 9. The reduction of the negative FRR Capacity of a LFC Block is:
 - i. limited to the difference, if positive, between the size of the negative Dimensioning Incident and the FRR Capacity required to cover the Negative LFC Block imbalances in 99 % of time based on historical records as defined in (a); and
 - ii. shall never exceed 30 % of the size of the Negative Dimensioning Incident.
- (3) All TSOs of a LFC Block where the LFC Block comprises more than one TSO, shall define in the LFC Block Operational Agreement the specific allocation of responsibilities between TSOs of the LFC Areas for the implementation of the obligations established in Section 7.1, paragraph (2).
- (4) All TSOs of a LFC Block shall have sufficient FRR Capacity according to the FRR Dimensioning Rules at any time. For the case of a severe risk of insufficient FRR Capacity of a LFC Block an escalation procedure shall be defined in the LFC Block Operational Agreement by all TSOs of a LFC Block.

7.2 FRR Technical Minimum Requirements

- (1) The FRR Technical Minimum Requirements shall be:
- a) Each FRR Providing Unit and each FRR Providing Group shall be connected to only one Reserve Connecting TSO;
 - b) A FRR Providing Unit or FRR Providing Group shall activate FRR according to the Setpoint received from the Reserve Instructing TSO;
 - c) The Reserve Instructing TSO shall be the Reserve Connecting TSO or a TSO that shall be defined by the Reserve Connecting TSO in an FRR Exchange Agreement according to the provisions of Section 9.1.3, paragraph (3) or Section 9.2.1, paragraph (4);
 - d) A FRR Providing Unit or FRR Providing Group for Automatic FRR shall have an Automatic FRR Activation Delay of at most 30 seconds;
 - e) A FRR Provider shall ensure that monitoring of the FRR activation of the FRR Providing Units within a Reserve Providing Group is possible. For this the FRR Provider shall be able to supply to the Reserve Connecting TSO and the Reserve Instructing TSO real-time measurements of the Connection Point or another point of interaction agreed with the Reserve Connecting TSO of:
 - i. Time-stamped scheduled Active Power output; and

ii. Time-stamped instantaneous Active Power;

For each FRR Providing Unit, each FRR Providing Group, and each Power Generating Module or Demand Unit of a FRR Providing Group with a maximum Active Power output larger than or equal to 1.5 MW;

- f) A FRR Providing Unit or FRR Providing Group for Automatic FRR shall be able to activate its complete FRR Capacity within the Automatic FRR Full Activation Time;
 - g) A FRR Providing Unit or FRR Providing Group for manual FRR shall be able to activate its complete manual FRR Capacity within the Manual FRR Full Activation Time;
 - h) A FRR Provider shall fulfil the FRR Availability Requirements;
 - i) A FRR Providing Unit or FRR Providing Group shall fulfil the ramp rate requirements of the LFC Block.
- (2) All TSOs of a LFC Block shall define in the LFC Block Operational Agreement FRR Availability Requirements and requirements on the control quality of FRR Providing Units and FRR Providing Groups for their LFC Block while respecting the provisions of Section 7.1.
- (3) The Reserve Connecting TSO shall define technical requirements for the connection of FRR Providing Units and FRR Providing Groups to ensure that the delivery of FRR is possible in a safe and secure way.
- (4) The Reserve Connecting TSO shall have the right to exclude FRR Providing Groups from the provision of FRR based on technical arguments such as the geographical distribution of the Power Generating Modules or Demand Units establishing an FRR Providing Group to ensure Operational Security.
- (5) Each TSO shall implement a FRR Prequalification to assess the fulfilment of the FRR Technical Minimum Requirements according to (1) above, the FRR Availability Requirements and the ramp rate requirements according to (2) above and the connection requirements according to (3) above by potential FRR Providing Units and FRR Providing Groups. This process shall include at least a reassessment in case requirements or equipment change and a periodical reassessment within the time frame of at least five years.
- (6) A potential FRR Provider shall have the right to apply for a Prequalification of potential FRR Providing Units and FRR Providing Groups at a relevant Reserve Connecting TSO or at a TSO that shall be defined by the Reserve Connecting TSO in a FRR Exchange Agreement according to the provisions of Section 9.1.3, paragraph (3) (e) or Section 9.2.1, paragraph (4).
- A TSO shall process an application for Prequalification within 3 months and shall prequalify FRR Providing Units or FRR Providing Groups which fulfil the FRR Technical Minimum Requirements according to (1) above, the FRR Availability Requirements and the ramp rate requirements according to (2) above and the connection requirements according to (3) above.
- (7) Each FRR Provider shall:
- a) ensure that its FRR Providing Units and FRR Providing Groups fulfil the FRR Technical Minimum Requirements, the FRR Availability Requirements and the ramp rate requirements according to (1) to (3) above;
 - b) inform its Reserve Instructing TSO about a reduction of the actual availability of its FRR Providing Unit or its FRR Providing Group or a part of its FRR Providing Group without undue delay.

- (8) Each Reserve Instructing TSO shall ensure that for its FRR Providing Units and FRR Providing Groups the fulfilment of the FRR Technical Minimum Requirements according to (1) above, the FRR Availability Requirements and the ramp rate requirements according to (2) above and the connection requirements according to (3) above are monitored.

8. Replacement Reserves (RR) (or Tertiary Reserves)

8.1 RR Dimensioning

- (1) All TSOs of a LFC Block shall have the right to implement a Reserve Replacement Process.
- (2) All TSOs of a LFC Block with a RRP according to Section 4.2, paragraph (2) and Section 8.1, paragraph (1), performing a combined Dimensioning Process of FRR and RR to fulfil the requirements of Section 7.1, paragraph (2) shall define in the LFC Block Operational Agreement the RR Dimensioning Rules in order to respect the FRCE Target Parameters in accordance with Section 3.2.
- (3) The RR Dimensioning Rules shall comprise at least the following requirements:
 - a) sufficient positive RR Capacity to restore the required amount of positive FRR;
 - b) sufficient negative RR Capacity to restore the required amount of negative FRR;
 - c) sufficient RR Capacity, if taken into account to dimension the FRR Capacity to respect the FRCE Quality Target for the considered period of time, based on theoretical considerations; and
 - d) respect the Operational Security within a LFC Block to determine RR Capacity.
- (4) All TSOs of a LFC Block are allowed to reduce the positive RR Capacity of the LFC Block, resulting from the RR Dimensioning Process, by concluding a RR Sharing Agreement for this positive RR Capacity with other LFC Blocks in accordance with the provisions of Chapter 9. The Control Capability Receiving TSO shall limit the reduction of its positive RR Capacity:
 - a) in order to guarantee that it can still meet its FRCE Quality Targets as set forth in Section 3.2;
 - b) in order to ensure that Operational Security is not endangered; and
 - c) in order to ensure that the reduction of the positive RR Capacity shall never exceed the remaining positive RR Capacity of the LFC Block.
- (5) All TSOs of a LFC Block are allowed to reduce the negative RR Capacity of the LFC Block, resulting from the RR Dimensioning Process, by concluding a RR Sharing Agreement for this negative RR Capacity with other LFC Blocks in accordance with the provisions of Chapter 9. The Control Capability Receiving TSO shall limit the reduction of its negative RR Capacity:
 - a) in order to guarantee that it can still meet its FRCE Quality Targets as set forth in Section 3.2;
 - b) in order to ensure that Operational Security is not endangered; and
 - c) in order to ensure that the reduction of the negative RR Capacity shall never exceed the remaining negative RR Capacity of the LFC Block.
- (6) Where a LFC Block is operated by more than one TSO, all TSOs of that LFC Block shall define in the LFC Block Operational Agreement the specific allocation of responsibilities between TSOs of different LFC Areas for the implementation of the obligations if the process is needed by a LFC Block.
- (7) A TSO shall have sufficient RR Capacity according to the RR Dimensioning Rules at any time. For the case of a severe risk of insufficient RR Capacity of a LFC Block an escalation procedure shall be defined in the LFC Block Operational Agreement by all TSOs of a LFC Block.

8.2 RR Technical Minimum Requirements

- (1) The RR Technical Minimum Requirements for RR Providing Units and RR Providing Groups shall be:
 - a) each RR Providing Unit and each RR Providing Group shall be connected to only one Reserve Connecting TSO;
 - b) a RR Providing Unit or RR Providing Group shall activate RR according to the Setpoint received from the Reserve Instructing TSO;
 - c) the Reserve Instructing TSO shall be the Reserve Connecting TSO or a TSO that shall be defined by the Reserve Connecting TSO RR Exchange Agreement according to the provisions of Section 9.1.3, paragraph (3) or Section 9.2.1, paragraph (4);
 - d) a RR Providing Unit or RR Providing Group shall activate its complete RR Capacity within the activation time defined by the Instructing TSO;
 - e) a RR Providing Unit or RR Providing Group shall de-activate RR according to the Setpoint received from the Reserve Instructing TSO;
 - f) a RR Provider shall ensure that monitoring of the RR activation of the RR Providing Units within a Reserve Providing Group is possible. For this, the RR Provider shall be able to supply to the Reserve Connecting TSO and the Reserve Instructing TSO real-time measurements of the Connection Point or another point of interaction agreed with the Reserve Connecting TSO of:
 - i. Time-stamped scheduled Active Power output; and
 - ii. Time-stamped instantaneous Active Power;

For each Power Generating Module or Demand Unit of a RR Providing Group with a maximum Active Power output larger than or equal to 1.5 MW; and
 - g) a RR Providing Unit or RR Providing Group shall fulfil the RR Availability Requirements.
- (2) All TSOs of a LFC Block shall define, in the LFC Block Operational Agreement, RR Availability Requirements and requirements on the control quality of RR Providing Units and RR Providing Groups for their LFC Block while respecting the provisions of Section 7.1.
- (3) The Reserve Connecting TSO shall define technical requirements for the connection of RR Providing Units and RR Providing Groups to ensure that the delivery of RR is possible in a safe and secure way.
- (4) The Reserve Connecting TSO shall have the right to exclude RR Providing Groups from the provision of RR based on technical arguments such as the geographical distribution of the Power Generating Modules or Demand Units establishing an RR Providing Group to ensure Operational Security.
- (5) Each TSO shall implement a RR Prequalification to assess the fulfilment of the technical and Availability Requirements by possible RR Providing Units and RR Providing Groups according to (1) to (3) above. This process shall include at least a reassessment in case requirements or equipment change and a periodical reassessment within the time frame of at least five years.
- (6) A potential RR Provider shall have the right to apply for a Prequalification of potential RR Providing Units and RR Providing Groups at a relevant Reserve Connecting TSO or at a TSO that shall be defined by the Reserve Connecting TSO in a RR Exchange Agreement according to the provisions of Section 9.1.3, paragraph (3) or Section 9.2.1, paragraph (4).

A TSO shall process an application for Prequalification within 3 months and shall prequalify RR Providing Units or RR Providing Groups that fulfil the RR Technical Minimum Requirements according to (1) above, the RR Availability Requirements according to (2) above and the connection requirements according to (3) above.

- (7) Each RR Provider shall:
 - a) ensure that its RR Providing Units and RR Providing Groups fulfil the RR technical minimum requirements and the RR Availability Requirements according to (1) to (3) above; and
 - b) inform its Reserve Instructing TSO about a reduction of the actual availability or a Forced Outage of its RR Providing Unit or its RR Providing Group or a part of its RR Providing Group without undue delay.
- (8) Each Reserve Instructing TSO shall ensure that, for its RR Providing Units and RR Providing Groups, the fulfilment of the RR Technical Requirements according to (1) above and the RR Availability Requirements according to (2) above and the connection requirements according to (3) above are monitored.

9. Exchange and Sharing of Reserves

9.1 Exchange and Sharing of Reserves within a Synchronous Area

9.1.1 Exchange of FCR within a Synchronous Area

- (1) The Exchange of FCR within a Synchronous Area is allowed in accordance with the provisions and limits of this Section. The Exchange of FCR invokes a transfer of FCR Obligation from the Reserve Receiving TSO to the Reserve Connecting TSO for the considered FCR Capacity.
- (2) All TSOs involved in the Exchange of FCR within a Synchronous Area shall ensure to respect the limits and requirements for the Exchange of FCR within the Synchronous Area as defined in the Table below:

Exchange of FCR allowed between:	Limits for the Exchange of FCR:
TSOs of Adjacent LFC Blocks	<ul style="list-style-type: none"> ▪ The TSOs of a LFC Block shall ensure that at least 30% of their total combined Initial FCR Obligations, according to Section 6.1, paragraph (1), is physically provided inside their LFC Block; and ▪ The amount of FCR Capacity, physically located in a LFC Block as a result of the Exchange of FCR with other LFC Blocks, shall be limited to the maximum of: <ul style="list-style-type: none"> ○ 30 % of the total combined Initial FCR Obligations, according to Section 6.1, paragraph (1), of the TSOs of the LFC Block to which the FCR Capacity is physically connected; and ○ 100 MW of FCR Capacity.
TSOs of the LFC Areas of the same LFC Block	<ul style="list-style-type: none"> ▪ The TSOs of the LFC Areas constituting a LFC Block shall have the right to define in the LFC Block Operational Agreement internal limits for the Exchange of FCR between the LFC Areas of the same LFC Block in order to: <ul style="list-style-type: none"> ○ avoid internal congestions in case of the activation of FCR; ○ ensure an even distribution of FCR Capacity for the case of network splitting; and ○ avoid that the stability of the FCP or the Operational Security is affected.

Table 9-1 – Limits and requirements for the Exchange of FCR

- (3) In case of the Exchange of FCR, the Reserve Connecting TSO and Reserve Receiving TSO shall perform a notification process according to Section 4.11.

- (4) Any Reserve Connecting TSO, Reserve Receiving TSO or Affected TSO involved in the Exchange of FCR has the right to refuse the Exchange of FCR in case the Exchange of FCR would result in power flows in violation of the Operational Security Limits when activating the FCR Capacity subject to the Exchange of FCR.
- (5) Each Affected TSO shall verify that its Reliability Margin, defined according to the [GMS Network Code on Capacity Allocation and Congestion Management – CACM, Chapter 2 of the GMS Market Code], is sufficient to accommodate the flows resulting from the activation of the FCR Capacity subject to the Exchange of FCR.
- (6) All TSOs of a LFC Area shall adjust the parameters of their FRCE calculation to account for the Exchange of FCR.
- (7) The Reserve Connecting TSO shall be responsible for the requirements according to Section 6.2 and Section 6.3 with regards to the FCR Capacity subject to the Exchange of FCR.
- (8) The FCR Providing Unit or Group shall only have a responsibility for FCR activation towards its Reserve Connecting TSO.
- (9) The involved TSOs shall ensure that Exchange of FCR does not hinder any TSO to fulfil the reserve requirements according to the provisions of Section 6.3.

9.1.2 Sharing of FCR within a Synchronous Area

- (1) It is prohibited for a TSO to perform Sharing of FCR with other TSOs of its Synchronous Area in order to fulfil its FCR Obligation and to reduce the total amount of FCR of the Synchronous Area as defined in accordance with Section 6.1, paragraph (1).

9.1.3 General Requirements for the Exchange of FRR and RR within a Synchronous Area

- (1) All TSOs of a Synchronous Area shall define, in the Synchronous Area Operational Agreement, the roles and the responsibilities of the Reserve Connecting TSO, the Reserve Receiving TSO and the Affected TSO for the Exchange of FRR and/or RR.
- (2) In case of the Exchange of FRR/RR, the Reserve Connecting TSO and Reserve Receiving TSO shall perform a notification process according to Section 4.11.
- (3) The Reserve Connecting and Reserve Receiving TSOs involved in the Exchange of FRR/RR shall define in a FRR or RR Exchange Agreement their roles and responsibilities including but not limited to:
 - a) the responsibility of the Reserve Instructing TSO for the FRR/RR Capacity subject to the Exchange of FRR/RR;
 - b) the amount of the FRR/RR Capacity subject to the Exchange of FRR/RR;
 - c) the implementation of the Cross-Border FRR/RR Activation Process according to Section 4.8 and Section 4.9;
 - d) FRR/RR Technical Minimum Requirements related to the Cross-Border FRR/RR Activation Process where the Reserve Connecting TSO is not the Reserve Instructing TSO;
 - e) the implementation of the FRR/RR Prequalification for the FRR/RR Capacity subject to the Exchange of FRR/RR according to Section 7.2, paragraph (5) and Section 8.2, paragraph (5);

- f) the responsibility to monitor the fulfilment of the FRR/RR Technical Requirements and FRR/RR Availability Requirements for the FRR/RR Capacity subject to the Exchange of FRR/RR according to Section 7.2, paragraph (8) and Section 8.2, paragraph (8); and
 - g) procedures to ensure that the Exchange of FRR/RR does not lead to power flows in violation with the Operational Security Limits.
- (4) Any Reserve Connecting TSO, Reserve Receiving TSO or Affected TSO involved in the Exchange of FRR/RR has the right to refuse the Exchange of FRR/RR in case the Exchange of FRR/RR would lead to power flows in violation of the Operational Security Limits when activating the FRR/RR Capacity subject to the Exchange of FRR/RR.
 - (5) The involved TSOs shall ensure that Exchange of FRR/RR does not prevent any TSO from fulfilling the reserve requirements according to the FRR or RR Dimensioning Rules.
 - (6) All TSOs of a LFC Block shall define in the LFC Block Operational Agreement their roles and the responsibilities as the Reserve Connecting TSO, the Reserve Receiving TSO and the Affected TSO for the Exchange of FRR and/or RR with TSOs of other LFC Blocks.

9.1.4 General Requirements for the Sharing of FRR and RR within a Synchronous Area

- (1) All TSOs of a Synchronous Area shall define in the Synchronous Area Operational Agreement the roles and responsibilities of the Control Capability Providing TSO, the Control Capability Receiving TSO and the Affected TSO for the Sharing of FRR/RR.
- (2) In case of the Sharing of FRR/RR, the Control Capability Providing TSO and Control Capability Receiving TSO shall perform a notification process according to Section 4.11.
- (3) The Control Capability Receiving TSO and the Control Capability Providing TSO participating in the Sharing of FRR/RR shall define in a FRR or RR Sharing Agreement their roles and responsibilities including but not limited to:
 - a) the amount of FRR/RR Capacity subject to the Sharing of FRR/RR;
 - b) the implementation of the Cross-Border FRR/RR Activation Process according to Section 4.8 and Section 4.9; and
 - c) procedures to ensure that the activation of the FRR/RR Capacity subject to the Sharing of FRR/RR does not lead to power flows in violation with the Operational Security Limits.
- (4) Any Control Capability Providing TSO, Control Capability Receiving TSO or Affected TSO involved in the Sharing of FRR/RR has the right to refuse the Sharing of FRR/RR in case the Sharing of FRR/RR would lead to power flows in violation of the Operational Security Limits when activating the FRR/RR Capacity subject to the Sharing of FRR/RR.
- (5) In case of the Sharing of FRR/RR, the Control Capability Providing TSO shall make available part of its own FRR/RR Capacity required to fulfil its reserve requirements for FRR and/or RR resulting from the FRR/RR Dimensioning Rules of Section 7.1 and Section 8.1 to the Control Capability Receiving TSO. The Control Capability Providing TSO can be either:
 - a) the Reserve Instructing TSO for the FRR/RR Capacity subject to the Sharing of FRR/RR; or

- b) the TSO having access to its FRR/RR Capacity subject to the Sharing of FRR/RR through an implemented Cross-Border FRR/RR Activation Process as part of an FRR/RR Exchange Agreement.
- (6) Each Control Capability Receiving TSO shall remain responsible to cope with incidents and imbalances in case the FRR/RR Capacity subject to the Sharing of FRR/RR are unavailable due to:
 - a) constraints for Frequency Restoration or Replacement Power Interchange related to Operational Security;
 - b) partial or full usage of the FRR/RR Capacity by the Control Capability Providing TSO.
- (7) All TSOs of a LFC Block shall define, in the LFC Block Operational Agreement, their roles and the responsibilities as the Control Capability Providing TSO, the Control Capability Receiving TSO and the Affected TSO for the Sharing of FRR and RR with TSOs of other LFC Blocks.

9.1.5 Exchange of FRR within a Synchronous Area

The Exchange of FRR within a Synchronous Area is allowed in accordance with the provisions of this Section and Section 9.1.3. All TSOs in a Synchronous Area consisting of more than one LFC Block involved in the Exchange of FRR within the Synchronous Area shall ensure to respect the requirements and limits as defined in Table below:

Exchange of FRR allowed between:	Limits for the Exchange of FRR:
TSOs of different LFC Blocks	<ul style="list-style-type: none"> ▪ The TSOs of a LFC Block shall ensure that at least 50% of their total combined FRR Capacity resulting from the FRR Dimensioning Rules according to Section 7.1, paragraph (1) and before any reduction due to the Sharing of FRR according to Section 7.1, paragraph (2) remains located within their LFC Block.
TSOs of the LFC Areas of the same LFC Block	<ul style="list-style-type: none"> ▪ The TSOs of the LFC Areas constituting a LFC Block shall have the right, if required, to define internal limits, for the Exchange of FRR between the LFC Areas of the LFC Block in the LFC Block Operational Agreement as to: <ul style="list-style-type: none"> ○ avoid internal congestions due to the activation of the FRR Capacity subject to the Exchange of FRR; ○ ensure an even distribution of FRR throughout the Synchronous Areas and LFC Blocks in case of network splitting; and ○ avoid that the stability of the FRP or the Operational Security is affected.

Table 9-2 - Requirements and Limits for the Exchange of FRR within the Synchronous Area

9.1.6 Sharing of FRR within a Synchronous Area

Each TSO of a LFC Block shall have the right to perform Sharing of FRR with other LFC Blocks of its Synchronous Area within the limits set by the FRR Dimensioning

Rules in Section 7.1, paragraph (1) while respecting the general provisions of Section 9.1.4.

9.1.7 Exchange of RR within a Synchronous Area

- (1) The Exchange of RR within the Synchronous Area is allowed in accordance with the provisions of this Section and Section 9.1.3.
- (2) All TSOs in a Synchronous Area consisting of more than one LFC Block involved in the Exchange of RR within the Synchronous Area shall ensure to respect the requirements and limits for the Exchange of RR as defined in the Table below:

Exchange of RR allowed between:	Limits for the Exchange of RR:
TSOs of different LFC Blocks	<ul style="list-style-type: none"> ▪ The TSOs of the LFC Areas constituting a LFC Block shall ensure that at least 50% of their total combined RR Capacity resulting from the RR Dimensioning Rules according to Section 8.1 and before any reduction of RR Capacity as a result of the Sharing of RR according to Section 8.1, paragraphs (4) and (5) remains located within their LFC Block.
TSOs of the LFC Areas of the same LFC Block	<ul style="list-style-type: none"> ▪ The TSOs of the LFC Areas constituting a LFC Block shall have the right, if required, to define internal limits for the Exchange of RR between LFC Areas of the LFC Block in the LFC Block Operational Agreement as to: <ul style="list-style-type: none"> ○ avoid internal congestions due to the activation of RR Capacity subject to the Exchange of RR; ○ ensure an even distribution of RR throughout the Synchronous Area in case of network splitting; and ○ avoid that the stability of the RRP or the Operational Security is affected.

Table 9-3 - Requirements and Limits for the Exchange of RR within the Synchronous Area

9.1.8 Sharing of RR within a Synchronous Area

Each TSO of a LFC Block shall have the right to perform Sharing of RR with other LFC Blocks of the same Synchronous Area within the limits set by the RR Dimensioning Rules in accordance with Section 8.1, paragraphs (4) and (5) while respecting the provisions of Section 9.1.4.

9.2 Exchange and Sharing of Reserves between Synchronous Areas

9.2.1 General Requirements

- (1) Each operator and/or owner of an HVDC Interconnector interconnecting Synchronous Areas shall provide the capability where the technology is installed permitting the Connecting TSOs of the HVDC Interconnector to perform Exchange and Sharing of FCR, FRR and RR on HVDC Interconnectors.
- (2) All TSOs of the Synchronous Area shall define in the Synchronous Area Operational Agreement the roles and the responsibilities of the Reserve Connecting TSO, the Reserve Receiving TSO and the Affected TSO for the Exchange of Reserves and the

Control Capability Providing TSO, Control Capability Receiving TSO and Affected TSO for the Sharing of Active Power Reserves between Synchronous Areas.

- (3) In case of the Exchange or Sharing of FCR/FRR/RR, respectively the Reserve Connecting TSO and Reserve Receiving TSO or the Control Capability Providing TSO and the Control Capability Receiving TSO shall perform a notification process according to Section 4.11.
- (4) The Reserve Connecting and Reserve Receiving TSOs involved in the Exchange of Reserves shall define, in an Exchange Agreement, their roles and responsibilities including but not limited to:
 - a) the responsibility of the Reserve Instructing TSO for the Reserve Capacity subject to the Exchange Reserves;
 - b) the amount of the Reserve Capacity subject to the Exchange of Reserves;
 - c) the implementation of the Cross-Border FRR/RR Activation Process according to Sections 4.8 and 4.9.
 - d) the implementation of the Prequalification for the Reserve Capacity subject to the Exchange of Reserves according Section 7.2, paragraph (5) and Section 8.2, paragraph (5);
 - e) the responsibility to monitor the fulfilment of the Technical Requirements and Availability Requirements for the Reserve Capacity subject to the Exchange of Reserves according to Section 7.2, paragraph (8) and Section 8.2, paragraph (8); and
 - f) procedures to ensure that the Exchange of Reserves does not lead to power flows in violation with the Operational Security Limits.
- (5) The Control Capability Providing and Control Capability Receiving TSO involved in the Sharing of Reserves shall define in a Sharing Agreement their roles and responsibilities including but not limited to:
 - a) the amount of the Reserve Capacity subject to the Sharing of Reserves;
 - b) the implementation of the Cross-Border FRR/RR Activation Process according to Sections 4.8 and 4.9; and
 - c) the procedures to ensure that the Sharing of Reserves does not lead to power flows in violation with the Operational Security Limits.
- (6) The Reserve Connecting and Reserve Receiving TSOs involved in the Exchange of Reserves or the Control Capability Providing and Control Capability Receiving TSO involved in the Sharing of Reserves shall agree with the HVDC Interconnector owners and/or HVDC Interconnector Operators or various legal groupings of these, a HVDC operating and coordination agreement including but not limited to:
 - a) consider interactions across all timescales including planning and activation;
 - b) the MW/Hz sensitivity factor, linearity/dynamic or static/step response function of each link connecting any two or more given Synchronous Areas; and
 - c) the share/interaction of these functions across multiple HVDC paths between the Synchronous Areas.
- (7) Any Reserve Connecting TSO, Reserve Receiving TSO, Control Capability Providing TSO, Control Capability Receiving TSO or Affected TSO involved in the Exchange or Sharing of Reserves has the right to refuse the Exchange or Sharing of Reserve in case the Exchange or Sharing of Reserve would lead to power flows in violation of the Operational Security Limits when activating the Reserve Capacity subject to the Exchange or Sharing of Reserve.

- (8) The involved TSOs shall ensure that Exchange of Reserves between Synchronous Areas does not prevent any TSO from fulfilling the reserve requirements according to Sections 6.1, 7.1 and 8.1.
- (9) The Reserve Connecting and Reserve Receiving TSOs, respectively the Control Capability Providing and Control Capability Receiving TSO, shall define procedures in an Exchange Agreement or Sharing Agreement in case the Exchange respectively Sharing of Reserves between Synchronous Areas fails in real-time.

9.2.2 Exchange of FCR between Synchronous Areas

- (1) All TSOs of the Synchronous Area shall define in the Synchronous Area Operational Agreement a methodology to determine limits for the Exchange of FCR with their Synchronous Area. The methodology shall take into account:
 - a) the operational impact between the Synchronous Areas;
 - b) the stability of the FCP of the Synchronous Area;
 - c) the ability of the TSOs of the Synchronous Area to reach the Frequency Quality Target Parameters in accordance with Section 3.1; and
 - d) the Operational Security.
- (2) Each operator of a HVDC Interconnector shall control the Active Power Flow over the HVDC Interconnector in accordance with instructions defined by the TSOs of the Reserve Receiving TSO in accordance with the FCR requirements established in Section 6.2.
- (3) All TSOs involved in the Exchange of FCR between Synchronous Areas shall organise the Exchange of FCR in such a way that the TSOs of a first Synchronous Area may receive part of the total FCR Capacity required for their Synchronous Area as defined in accordance with the Section 6.1, paragraph (1) within a second Synchronous Area.
 The part of the total FCR Capacity required for the first Synchronous Area subject to the Exchange of FCR shall be provided within the second Synchronous Area in addition to the total FCR Capacity required for this second Synchronous Area in accordance with Section 6.1, paragraph (1).
- (4) All TSOs of the involved Synchronous Areas shall agree in a FCR Exchange Agreement upon the Exchange of FCR.
- (5) The Reserve Receiving TSO shall respect the provisions of Section 6.3, paragraph (5) in case of the Exchange of FCR between Synchronous Areas.

9.2.3 Sharing of FCR between Synchronous Areas

- (1) A TSO shall not share part of its FCR with other TSOs of another Synchronous Area.
- (2) Each operator of a HVDC Interconnector shall control the Active Power Flow over the HVDC Interconnector in accordance with instructions defined by the Control Capability Receiving TSO in accordance with the FCR requirements established in Section 6.2.
- (3) All TSOs involved in the Sharing of FCR between Synchronous Areas shall organise the Sharing of FCR in such a way that the TSOs of a first Synchronous Area may receive part of the total FCR Capacity required for their Synchronous Area as defined in accordance with the Section 6.1, paragraph (1) within a second Synchronous Area.
- (4) The Control Capability Receiving TSO shall respect the provisions of Section 6.3, paragraph (5) in case of the Sharing of FCR between Synchronous Areas.

9.2.4 General Requirements for the Sharing of FRR and RR between Synchronous Areas

- (1) In case of the Sharing of FRR/RR, the Control Capability Providing TSO shall make available part of its own FRR/RR Capacity required to fulfil its reserve requirements for FRR and/or RR resulting from the FRR/RR Dimensioning Rules of Sections 7.1 and 8.1 to the Control Capability Receiving TSO. The Control Capability Providing TSO can be either:
 - a) the Reserve Instructing TSO for the FRR/RR Capacity subject to the Sharing of FRR/RR; or
 - b) the TSO having access to its FRR/RR Capacity subject to the Sharing of FRR/RR through an implemented Cross-Border FRR/RR Activation Process as part of a FRR/RR Exchange Agreement.
- (2) All TSOs of a LFC Block shall define in the LFC Block Operational Agreement their roles and the responsibilities as the Control Capability Providing TSO, the Control Capability Receiving TSO and the Affected TSO for the Sharing of FRR and RR with TSOs of other LFC Blocks in other Synchronous Areas.

9.2.5 Exchange of FRR between Synchronous Areas

- (1) All TSOs of the Synchronous Areas shall define, in the Synchronous Area Operational Agreement, a methodology to determine limits for the Exchange of FRR with their Synchronous Area. The methodology shall take into account:
 - a) the operational impact between the Synchronous Areas;
 - b) the stability of the FRP of the Synchronous Area;
 - c) the ability of TSOs of the Synchronous Area to reach the Frequency Quality Target Parameters in accordance with Section 3.1 and the FRCE Target Parameters in accordance with Section 3.2, and
 - d) the Operational Security.
- (2) All TSOs of LFC Blocks involved in the Exchange of FRR between Synchronous Areas shall organise the Exchange of FRR in such a way that the TSOs of a LFC Block in the first Synchronous Area may receive part of the total FRR Capacity required for their LFC Block as defined in accordance with the Section 7.1, paragraph (1) from a LFC Block in the second Synchronous Area.
 The part of the total FRR Capacity required for the LFC Block in the Synchronous Area that is exchanged, shall be provided from the LFC Block in the second Synchronous Area in addition to the total FRR Capacity required for this second LFC Block in accordance with Section 7.1, paragraph (1).
- (3) Each operator of a HVDC Interconnector shall control the Active Power Flow over the HVDC Interconnector in accordance with instructions defined by either the Reserve Connecting TSO or Reserve Receiving TSO in accordance with the FRR Technical Minimum Requirements established in Section 7.2.
- (4) All TSOs of the LFC Blocks of the Reserve Connecting TSO and the Reserve Receiving TSO shall agree in a FRR Exchange Agreement upon the Exchange of FRR.

9.2.6 Sharing of FRR between Synchronous Areas

- (1) All TSOs of the Synchronous Area shall define in the Synchronous Area Operational Agreement a methodology to determine limits for the Sharing of FRR with their Synchronous Area. The methodology shall take into account:
 - a) the operational impact between the Synchronous Areas;
 - b) the stability of the FRP of the Synchronous Area;
 - c) the maximum reduction of FRR that can be taken into account in the FRR Dimensioning according to Section 7.1 as a result from the FRR Sharing;
 - d) the ability of the Synchronous Area to reach the Frequency Quality Target Parameters in accordance with Section 3.1 and the FRCE Target Parameters in accordance with Section 3.2; and
 - e) the Operational Security.
- (2) All TSOs of LFC Blocks involved in the Sharing of FRR between Synchronous Areas shall organise the Sharing of FRR in such a way that the TSOs of a LFC Block in the first Synchronous Area may receive part of the total FRR Capacity required for their LFC Block as defined in accordance with the Section 7.1, paragraph (1) from a LFC Block in the second Synchronous Area.
- (3) Each operator of a HVDC Interconnector shall control the Active Power Flow over the HVDC Interconnector in accordance with instructions defined by either the Control Capability Providing TSO or Control Capability Receiving TSO in accordance with the FRR Technical Minimum Requirements established in Section 7.1, paragraph (1).
- (4) All TSOs of the LFC Blocks of the Control Capability Providing and Control Capability Receiving TSOs and the Reserve Receiving LFC Block shall agree in a FRR Sharing Agreement upon the Sharing of FRR.

9.2.7 Exchange of RR between Synchronous Areas

- (1) All TSOs of the Synchronous Area shall define, in the Synchronous Area Operational Agreement, a methodology to determine limits for the Exchange of RR with their Synchronous Area. The methodology shall take into account:
 - a) the operational impact between the Synchronous Areas;
 - b) the stability of the RRP of the Synchronous Area;
 - c) the ability of the TSOs of the Synchronous Area to reach the Frequency Quality Target Parameters in accordance with Section 3.1 and the FRCE Target Parameters in accordance with Section 3.2; and
 - d) the Operational Security.
- (2) All TSOs of LFC Blocks involved in the Exchange of RR between Synchronous Areas shall organise the Exchange of RR in such a way that the TSOs of a LFC Block in the first Synchronous Area may receive part of the total RR Capacity required for their LFC Block as defined in accordance with the Section 8.1, paragraph (2) from a LFC Block in the second Synchronous Area.

The part of the total RR Capacity required for the LFC Block in the Synchronous Area which is exchanged shall be provided from the LFC Block in the second Synchronous Area in addition to the total RR Capacity required for this second LFC Block in accordance with Section 8.1, paragraph (2).

- (3) Each operator of a HVDC Interconnector shall control the Active Power Flow over the HVDC Interconnector in accordance with instructions defined by either the Reserve Connecting TSO or the Reserve Receiving TSO in accordance with the RR Technical Minimum Requirements established in Section 8.2.
- (4) All TSOs of the LFC Blocks of the Reserve Connecting TSO and the Reserve Receiving TSO shall agree in a RR Exchange Agreement upon the Exchange of RR.

9.2.8 Sharing of RR between Synchronous Areas

- (1) All TSOs of the Synchronous Area shall define in the Synchronous Area Operational Agreement a methodology to determine limits for the Sharing of RR with their Synchronous Area. The methodology shall take into account:
 - a) the operational impact between the Synchronous Areas;
 - b) the stability of the RRP of the Synchronous Area;
 - c) the maximum reduction of RR that can be taken into account in the RR Dimensioning according to Section 8.1 as a result from the RR Sharing;
 - d) the ability of the Synchronous Area to reach the Frequency Quality Target Parameters in accordance with Section 3.1 and the FRCE Target Parameters in accordance with Section 3.2; and
 - e) the Operational Security.
- (2) All TSOs of LFC Blocks involved in the Sharing of RR between Synchronous Areas shall organise the Sharing of RR in such a way that the TSOs of a LFC Block in the first Synchronous Area may receive part of the total RR Capacity required for their LFC Block as defined in accordance with the Section 8.1, paragraph (2) from a LFC Block in the second Synchronous Area.
- (3) Each operator of a HVDC Interconnector shall control the Active Power Flow over the HVDC Interconnector in accordance with instructions defined by either the Control Capability Providing TSO or the Control Capability Receiving TSO in accordance with the RR Technical Minimum Requirements established in Section 8.2.
- (4) All TSOs of the LFC Blocks of the Reserve Capability Providing and Reserve Capability Receiving TSO shall agree in a RR Sharing Agreement upon the Sharing of RR.

9.3 Cross-Border Activation Process for FRR / RR

9.3.1 Cross-Border Activation Process for FRR / RR

The cross-border activation of FRR and RR Capacity between TSOs of the same or different Synchronous Areas is allowed in accordance with the provisions of Sections 4.8 and 4.9.

10. Time Control Process

10.1 Time Control Process

- (1) The Electrical Time Control Process of a Synchronous Area shall be used to ensure that the average value of the System Frequency is equal to the Nominal Frequency.
- (2) Where applicable, all TSOs of a Synchronous Area shall define, in the Synchronous Area Operational Agreement, the methodology to correct the Electrical Time Deviation, which shall include:
 - a) time ranges within which the Electrical Time Deviation shall be maintained by the reasonable endeavours of TSOs;
 - b) Setpoint Frequency adjustments to return Electrical Time Deviation to zero;
 - c) commonly agreed actions to increase or decrease the average System Frequency by means of Active Power Reserves.
- (3) Where applicable, all TSOs of a Synchronous Area shall appoint one TSO, which shall:
 - a) monitor the Electrical Time Deviations;
 - b) calculate the Setpoint Frequency adjustments;
 - c) coordinate the actions of the Time Control Process.

11. Co-Operation with DSOs

11.1 Reserve Providing Units connected to the DSO Grid

- (1) TSOs and DSOs shall collaborate and use reasonable endeavours to facilitate and enable the delivery of Active Power Reserves by Reserve Providing Groups or Reserve Providing Units located in Distribution Networks.
- (2) The Reserve Connecting DSO and each intermediate DSO shall process the application of a Reserve Providing Unit or Reserve Providing Group connected to its Distribution Network within 2 months after provision of the notification and all the required information including:
 - a) voltage levels and Connection Points of the Reserve Providing Units or Groups;
 - b) the type of Active Power Reserves;
 - c) the maximum Reserve Capacity provided by the Reserve Providing Units or Groups at each Connection Point; and
 - d) the maximum rate of change of Active Power for the Reserve Providing Units or Groups.
- (3) During the Prequalification of a Reserve Providing Unit or Reserve Providing Group connected to its Distribution Network and in accordance with applicable legislation each Reserve Connecting DSO and each intermediate DSO shall have the right to set limits to or exclude the delivery of Active Power Reserves located in its Distribution Network in cooperation with the TSO and in a non-discriminatory and transparent way based on technical arguments such as the geographical distribution of the Reserve Providing Units and Reserve Providing Groups.

- (4) In accordance with applicable legislation, each Reserve Connecting DSO and each intermediate DSO shall have the right to set temporary limits at any point in time before reserve activation in cooperation with the TSO and in a non-discriminatory and transparent way to the delivery of Active Power Reserves located in its Distribution Network. The respective TSOs shall agree with its Reserve Connecting DSOs and intermediate DSOs on the applicable procedures.
- (5) In accordance with applicable legislation, the respective TSOs shall agree with its Reserve Connecting DSOs and intermediate DSOs on procedures and methodologies for the information exchange required in relation to Prequalification and the delivery of Active Power Reserves, including the notification of the Reserve Connecting DSO and intermediate DSOs.

12. Transparency of Information

12.1 General Transparency Requirements

- (1) All TSOs shall ensure that information mentioned in this Chapter is published at a time and in a format that does not create an actual or potential competitive advantage or disadvantage to any individual party or category of party.
- (2) Each TSO shall use the knowledge and tools available to this TSO to overcome technical constraints and to ensure the availability and the accuracy of the information made available to the RPCC in accordance with Section 12.3, paragraph (3) and Section 12.4.
- (3) All TSOs shall ensure the availability and the accuracy of the information made available to the RPCC in accordance with Section 12.3, paragraphs (1), (2) and (3), Sections 12.5, 12.6, 12.7, 12.8 and 12.9.
- (4) All material for publication mentioned in Sections 12.3, 12.5, 12.6, 12.7 and 12.8 shall be made available to the RPCC at least in English. The RPCC shall publish this material on the central information transparency platform.

12.2 Information on Operational Agreements

- (1) Each TSO of each Synchronous Area shall share the contents of its Synchronous Area Operational Agreement with its National Regulatory Authority or, where applicable, with another relevant national authority no later than one month before its entry into force.
- (2) All TSOs of each Synchronous Area shall make the contents of its Synchronous Area Operational Agreement available to the RPCC for publication no later than one week after its entry into force.
- (3) Each TSO of each LFC Block shall share the contents of its LFC Block Operational Agreement with its National Regulatory Authority or, where applicable, with another relevant national authority.

12.3 Information on Frequency Quality

- (1) Whenever modified values are defined in accordance with Section 3.1, paragraph (6), all TSOs of each Synchronous Area shall make the adopted values of the following parameters for their Synchronous Area available to the RPCC for publication no later

than one month before the entry into force of the Synchronous Area Operational Agreement in which they are contained:

- a) the Frequency Quality Defining Parameters; and
 - b) the Frequency Quality Target Parameter.
- (2) Where applicable, all TSOs of each Synchronous Area shall make the values of the FRCE Target Parameters for each LFC Block and each LFC Area within their Synchronous Area available to the RPCC for publication no later than one month before their applicability.
- (3) All TSOs of each Synchronous Area shall make the methodology used to determine the risk of FCR Exhaustion available to the RPCC for publication no later than three months before the entry into force of the Synchronous Area Operational Agreement in which it is contained.
- (4) The Synchronous Area Monitor of each Synchronous Area shall make the results of the Criteria Application Process for their Synchronous Area available to the RPCC for publication no later than three months after the last time stamp of the measurement period and at least four times a year. These results shall comprise at least:
- a) the values of the Frequency Quality Evaluation Criteria as calculated for the Synchronous Area and for each LFC Block within the Synchronous Area in accordance with Section 3.5, paragraph (3);
 - b) the measurement resolution, measurement accuracy and calculation method defined in accordance with Section 3.4; and
 - c) all TSOs of each Synchronous Area shall make the Ramping Period defined in accordance with Section 2.9 available to the RPCC for publication no later than three months before their applicability.

12.4 Annual Report on Load-Frequency Control

- (1) Starting at most two years after the entry into force of this Network Code, all TSOs of each country shall ensure the following information is available to the RPCC within three months after the end of each calendar year:
- a) the identification of the LFC Blocks, LFC Areas and Monitoring Areas contained within the country;
 - b) the identification of those LFC Blocks that are not contained within the country that contain LFC Areas and Monitoring Areas that are contained within the country;
 - c) the identification of the Synchronous Areas within which the country is contained;
 - d) the time evolution of the Frequency Quality Evaluation Criteria for each Synchronous Area and each LFC Block identified in points a), b), or c) of this paragraph over at least the last two calendar years;
 - e) the time evolution of the FCR Obligation and the Initial FCR Obligation of each TSO operating within the country over at least the last two calendar years; and
 - f) a description and date of implementation of any mitigation measures taken in the last calendar year in accordance with Section 3.11 in which TSOs of the country were involved.
- (2) Where appropriate, TSOs of a Synchronous Area or LFC Block shall collaborate in collecting the data listed in (1) above.

- (3) For each country, the RPCC shall include the information listed in (1) above within the annual report developed in accordance with Article 8 of the Inter-Governmental Agreement creating the RPCC.

12.5 Information on the Load-Frequency Control Structure

- (1) All TSOs of each Synchronous Area shall make the following information available to the RPCC no later than three months before the entry into force of the Synchronous Area Operational Agreement in which it is contained:
- a) information on the Process Activation Structure of the Synchronous Area, including at least information on the defined Monitoring Areas, LFC Areas and LFC Blocks and their TSOs; and
 - b) information on the Process Responsibility Structure of the Synchronous Area, including at least information on the defined processes listed in Section 4.2, paragraphs (1) and (2).
- (2) All TSOs implementing an Imbalance Netting Process shall publish information regarding this Imbalance Netting Process in accordance with national legislation. This information shall include at least the list of participating TSOs and the starting date of the Imbalance Netting Process.

12.6 Information on FCR

- (1) All TSOs of each Synchronous Area shall make the dimensioning approach for FCR for their Synchronous Area in accordance with Section 6.1, paragraph (4) available to the RPCC for publication no later than one month before its applicability.
- (2) Where applicable, all TSOs of each Synchronous Area shall make the total amount of FCR Capacity for their Synchronous Area and the shares of FCR Capacity required for each TSO defined in accordance with Section 6.1, paragraphs (1), (3) or (4) as the Initial FCR Obligation available to the RPCC for publication no later than one month before their applicability.
- (3) All TSOs of each Synchronous Area shall make the FCR properties defined for their Synchronous Area in accordance with Section 6.2, paragraph (2) and additional requirements for FCR Providing Groups in accordance with Section 6.2, paragraph (3) available to the RPCC for publication no later than three months before their applicability.

12.7 Information on FRR

- (1) All TSOs of each LFC Block shall make the FRR Availability Requirements and requirements for the control quality defined in accordance with Section 7.2, paragraph (2) and the technical requirements for the connection defined in accordance with Section 7.2, paragraph (3) for their LFC Block available to the RPCC for publication no later than three months before their applicability.
- (2) All TSOs of each LFC Block shall make the FRR Dimensioning Rules defined for their LFC Block in accordance with Section 7.1, paragraph (1) available to the RPCC for publication no later than three months before the entry into force of the LFC Block Operational Agreement in which they are contained.
- (3) All TSOs of each Synchronous Area shall make an outlook of the FRR Capacities of each LFC Block for the next year available to the RPCC for publication no later than 30 November of each year.

- (4) All TSOs of each Synchronous Area shall make the actual FRR capacities of each LFC Block of the past quarter available to the RPCC for publication no later than 30 days after the end of the quarter.

12.8 Information on RR

- (1) All TSOs of each LFC Block that operates a Reserve Replacement Process shall make the RR Availability Requirements defined in accordance with Section 8.2, paragraph (2) and the technical requirements for the connection defined in accordance with Section 8.2, paragraph (3) for their LFC Block available to the RPCC for publication no later than three months before their applicability.
- (2) All TSOs of each Synchronous Area shall make an outlook of the RR Capacities of each LFC Block for the next year available to the RPCC for publication no later than 30 November of the current year.
- (3) All TSOs of each Synchronous Area shall make the actual RR Capacities of each LFC Block of the past quarter available to the RPCC for publication no later than 30 days after the end of the quarter.

12.9 Information on Sharing and Exchange

- (1) All TSOs of each Synchronous Area shall make the annual compilations of the agreements for Sharing of FRR and for Sharing of RR for each LFC Block within the Synchronous Area available to the RPCC as part of the material for publication required by respectively Section 12.7, paragraph (3) and Section 12.8, paragraph (2). These compilations shall include the following information:
 - a) the identity of the LFC Blocks between which an agreement for Sharing of FRR or RR exists; and
 - b) the realized reduction of FRR and RR due to each agreement for the Sharing of respectively FRR or RR.
- (2) All TSOs of each country shall publish information on the Exchange of FCR, FRR and RR in accordance with national legislation.

13. Final Provisions

13.1 *Amendments of Contracts and General Terms and Conditions*

By [date – the same as the date in Section 13.2] each relevant TSO, DSO and each relevant Significant Grid User shall amend all relevant clauses in contracts and relevant clauses in general terms and conditions, regardless of whether the relevant contracts or general terms and conditions contain an amendment process, in order to achieve compliance with the requirements of this Network Code.

13.2 *Entry into Force*

This Network Code shall enter into force on the twentieth day following that its Official Adoption and Publication by the GMS RPTCC Meeting or Higher Regional Authority of [the Network Code on Operational Security, Operational Planning and Scheduling, or Load Frequency Control and Reserves, whichever is the latest].

With the exception of the Section 1.8 and Sections 2.1 to 2.4 which shall apply as from the entry into force, this Network Code shall apply as from [date – *at minimum 18 months after entry into force*].

This Network Code shall be binding in its entirety and directly applicable in all Member States.

ANNEX: Load Frequency Control and Reserves Code – History of Comments

#	Country	Reference section in the document	Country Comment	Consultants Review and Recommendation	Country Acceptance
1.					
2.					
3.					
4.					
5.					
6.					